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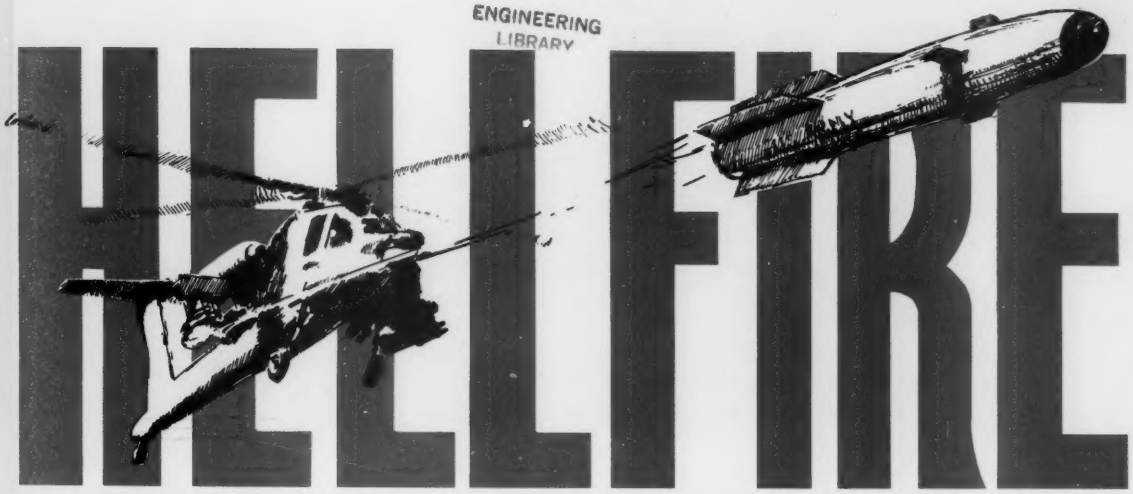

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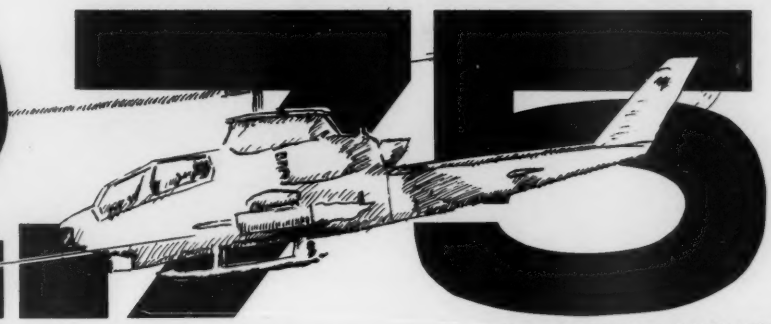

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MAY 1978
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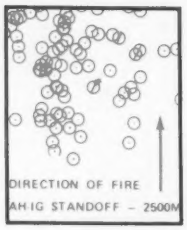
page 4



page 10

1 **Army Aviation In The Pacific,** MG James C. Smith
2 **Air Combat Engagements,** MAJ Charles C. Crowley
4 **HELLFIRE—A Weapon System Whose Time Has Come!** MAJ Jeffrey H. Thomason
10 **2.75 Update. Whatever Happened To "The Egg On The Wall"?** COL James L. Tow
16 **We Can No Longer Chase The Four Winds**
20 **DES Report To The Field**
22 **A Story Of Survival,** Thomas E. Martin
24 **First 175/40 IERW Graduates,** CPT Thomas P. Brown Jr.
26 **EPMS Corner: Air Traffic Controllers And Flight Operations Coordinators,** MAJ Melvin L. Davis
28 **OPMS Corner: Graduate Flight Training And Aviator Management,** MAJ Jacob B. Couch Jr.
29 **Helicopter Control System**
30 **Reliability Testing—Why We Need It,** Robert L. Miller
33 **Protection Of Medical Aircraft, Part Two,** COL Waldemar A. Solf (Retired)
37 **Views From Readers**
40 **Air Assault School,** MAJ A.T. Brainerd
41 **Know The Threat**
42 **Summer Thunderstorm, Pilot Enemy Number 1**
46 **PEARL**
48 **ATC Action Line**

Inside Back Cover: You Wanna Hear From Me
Back Cover: AVNEC

page 16

page 40

page 46

Richard K. Tierney
Editor

ABOUT THE COVER

What's new with the HELLFIRE missile and the 2.75 inch rocket? See articles beginning on pages 6 a 4 and 10. Cover art by Fred Martin

The mission of the *U.S. Army Aviation Digest* is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

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Articles, photos and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, *U.S. Army Aviation Digest,* Fort Rucker, AL 36362.

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General Smith

Army Aviation in the PACIFIC

Major General James C. Smith
Commander
U.S. Army Aviation Center
Fort Rucker, AL

The Commander, U.S. Army Aviation Center and Ft. Rucker, reflects on his recent trip to visit Army aviation units in the Pacific. He shares concerns and problem areas expressed to him and what is being done to offset them.

THE U.S. ARMY Aviation Center is dedicated to providing the latest doctrine and highest professional training for Army aviation personnel who serve as members of the combined arms team and will face the enemy on the high threat battlefield. Our objective is to prepare for and ensure victory in the first battle. In order to accomplish this mission, it is essential to stay abreast of unit problems, monitor operations and employment of aviation units and talk to personnel in the field who employ aviation doctrine and training produced by the Aviation Center.

Last November and December I visited Army aviation units in the Pacific. These included elements of the 17th Aviation Group, the 2d Infantry Division, the 45th Transportation Company, and the 377th Medical Company stationed in Korea. Enroute home I also visited with members of the aviation detachment in Japan and the 25th Infantry Division in Hawaii. Throughout the trip I was impressed by the high state of readiness and "can do" attitude found in the units I visited.

There were several problem areas presented to me which I feel the Aviation Center can help solve. In this article I want to share with the *Digest's* readers several actions being taken by the Aviation Center to help resolve certain of these problems which appear to be worldwide.

ATC Training: During our discussions on air traffic control I mentioned that FOC/FCC training at skill level 10 is in the final stages of development and that instruction is expected to begin in May. The Aviation Center ATC school, in coordination with the Initial Entry Rotary Wing (IERW) program has initiated tactical field training that will include the 71P, the 93H/J and student aviators. The scenario depicts receipt of a mission from the unit operations (71P students) at the Division Instrumented Airfield which is operated by the students. The IERW students execute the mission flying under FOC/FCC control operated by the 93H/J students. As the mission progresses, FOC/FCC controllers implement mission changes which direct the IERW students to varied tactical beacons in forward LZs. Beacons are set up and operated by ATC students who also act as tactical tower (foxhole) control teams to assist and guide the student pilots into the LZ.

In addition, all training material in 93H and J is being reviewed and will become more comprehensive with programed revisions. Other changes include area orientation for CONUS and overseas areas. Orientation consists of classes, film strips, and related information for students who desire the training prior to geographical area assignment. Additionally, the Aviation Center has incorporated radio procedure and routine operator maintenance training in the program for ATC and flight operation students.

The 93H/J SQTs for skill levels 2 through 4 have been prepared and units will receive test instructions in July, August and September this

Continued on page 8

Air Combat Engagements

Major Charles C. Crowley
Attack Helicopter TSM Office
Ft. Rucker, AL

NOT 10 YEARS ago U.S. Army helicopters were employed at altitudes unheard of today. Becoming more aware of the threat and its air defense capability, the Army started a tactics development phase that would allow it to fight and simultaneously increase its survivability. This resulted in our training being shifted from "wild blue yonder" into flight modes known as nap-of-the-earth (NOE) or terrain flight. Now few persons question the advantages of terrain flight modes or that there are problems associated with it.

Again, the U.S. Army is evaluating its helicopter tactics and training. Sure, we still have the ground threat but now another major threat has been introduced against our forces, both air and ground. This threat is the Mi-24 Hind attack helicopter. The Mi-24 is being fielded in three versions, the Hind A, B and D. For discussion purposes, this article will concentrate only on the total system and its capabilities, not the model differences.

The Mi-24 is a twin engine helicopter possessing a five-bladed main rotor and a three-bladed tail rotor system. Its speed is in excess of 140 knots. Like our attack helicopters, a various ordnance mix can be carried. This mix can consist of a 12.7 millimeter (mm) swivel-mounted machinegun, located in the helicopter's nose. There are indications that this cannon also could be replaced with a 23 mm radar-directed gun.

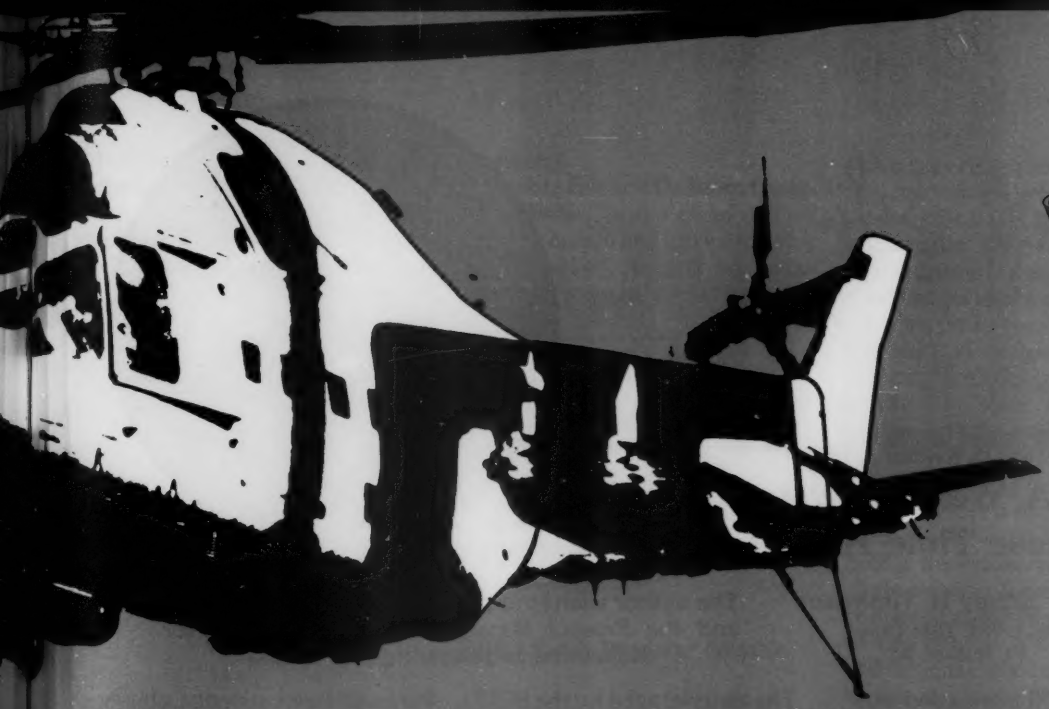
Hard points on each wing allow the aircraft to carry four 57 mm rocket pods (32 rockets per pod). These rockets can be fitted with various types of warheads. Also on the wing tips are four antitank guided missile (ATGM) launch rails. This allows the Hind to carry four Swatters or four Sagger air to ground missiles.

Using all onboard weapons, the Hind helicopter poses a serious threat to both ground and air assets of U.S. forces.

Since enemy planners normally employ vehicles en masse on the battlefield, it is envisioned that will hold true also for employment of their helicopters. If this assumption is valid, U.S. forces must be prepared to counter the air threat. To assess this problem, a tactics developments program, known as Air Combat Engagement (ACE), is underway at the Aviation Center.

In order to assess effectively the impact of ACE, it is planned to be conducted in multiple phases. Phase I was started in November 1977 and was completed in December 1977. During Phase I an instrumented AH-1S Cobra was employed against a UH-1M Huey in a one-on-one evaluation using six tactical scenarios. The AH-1S was evaluated in three major areas: detection avoidance, evasive maneuvers and current weapons effectiveness against armed helicopters. Throughout Phase I, the UH-1M was employed, using current threat flight profiles. The AH-1S flight profiles were not held consistent with current doctrine, in an effort to investigate any and all possibilities of a tactics or technique that would allow the AH-1S an advantage. While not always flying current antiarmor doctrine, the AH-1S crew was instructed that its profiles must always consider the ground and air defense threat, consistent with the given scenario.

During Phase I it was apparent



that terrain flight will allow the AH-1S a marked advantage in visual detection avoidance. Although not surprising, pilots must now think about flying NOE in slightly different terms. Areas previously free from ground observation quickly can become danger areas when an air threat is introduced. Additionally, aircrews must now divide their attention to not only searching for ground targets but must also be alert for an aerial threat.

Another area of increased difficulty is that of NOE navigation. Crewmembers must concentrate their attention outside the cockpit and not "stay on the map" constantly. For once detected, their responses must be immediate. This response time was found, after numerous simulated aerial engagements, to be less than 10 seconds after the aircraft visually was detected by another attack helicopter. This fast pace of aerial combat highlights the fact that crew integrity is vital. During Phase I nontest personnel were inserted as AH-1S crewmembers. Immediately the AH-1S crew performance was degraded seriously. A marked advantage is afforded the first aircraft able to place quick accurate firepower on its adversary. Since time now becomes critical, it was found that cockpit switches required to fire weapons, must now be relocated to minimize engagement times.

Phase II is scheduled to begin sometime in 1978. During this Phase about 30 aviators will be trained in aerial combat, using tactics and techniques learned from Phase I. This training will be modified continually so as to enable the Aviation Center to develop a training program that is suitable for force training. Additionally, steps are underway to replace the UH-1M threat simulators with aircraft that more closely simulate the threat in terms of size, speed and performance.

Upon completion of Phase II it is envisioned that follow-on testing will continue. Test personnel consider one-on-one testing as only a stepping stone to force-on-force testing. Numerous one-on-one engagements that occurred during Phase I would have been altered significantly with the involvement of multiple aircraft. When a single aircraft is moving on the battlefield it is vulnerable to being attacked from the rear where vision is void. Employment of multiple aircraft will require tactics that will allow movement while simultaneously covering your wing's 6 o'clock position.

As in all areas of tactical employment training is the key.

It has been proven time and again that Soldiers fight like they are trained. No aerial combat training exists for Army aviators. This is not to advocate that we should train to seek out and kill an aerial threat, but we at least should equip our aviators with the capability and training needed to defend themselves. Training essential in air-to-air is:

- Aircraft recognition
- Threat detection
- Range estimation
- Threat capabilities and limitations
- Action on contact
- Know your aircraft's capabilities and limitations
- Crew/team training

We must train now—not tomorrow! After the first threat helicopter attack it is too late for training programs to commence.

HELLFIRE

A Weapon System Whose Time Has Come

Major Jeffrey H. Thomason
HELLFIRE TSM Office
Ft. Rucker, AL

The author wishes to thank Rockwell International and the Project Manager HELLFIRE office for assistance in preparing this article

THE ARMY'S newest and most effective antitank weapon system—the HELLFIRE—derives its name from "Helicopter Launched Fire And Forget," due to its employment as the major armament subsystem of the AH-64 advanced attack helicopter, its standoff range, and seeker growth potential to a "fire and forget" missile.

The AH-64 provides battlefield mobility and tactical agility, while the HELLFIRE missile delivers the devastating and deadly punch (figure 1).

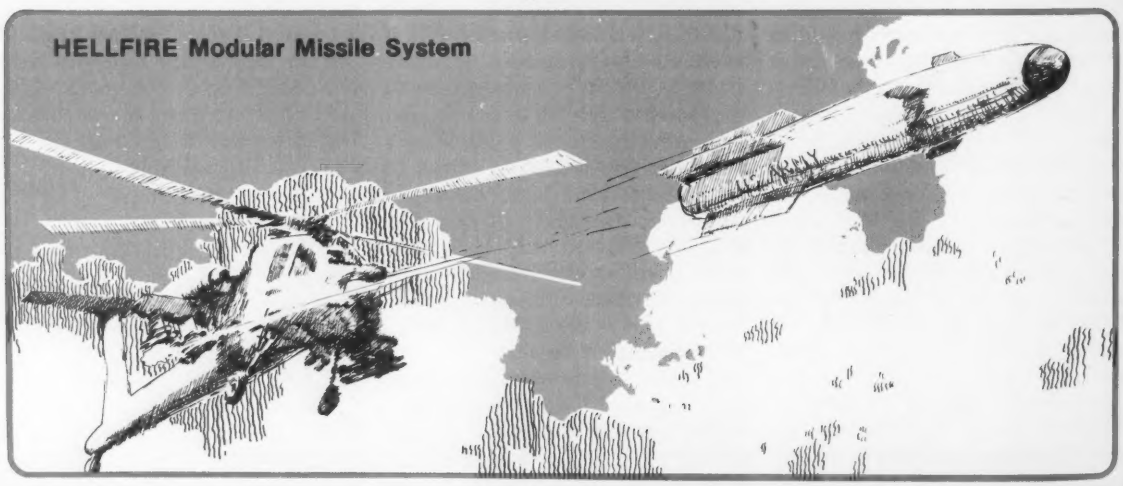
The materiel need for the HELLFIRE was approved by the Department of the Army on 29 Dec 1972. Since, it has been revalidated and updated to reflect current AH-64 and HELLFIRE program philosophy.

In February 1976 HELLFIRE was designated the point target weapon for the advanced attack helicopter, now designated the AH-64. Following a comprehensive evaluation of proposals submitted by competing contractors, the full-scale engineering development contract was awarded to the Missile Systems Division, Rockwell International, Columbus, OH. HELLFIRE is in its second year of a 5-year development program.

The versatile HELLFIRE Modular Missile System, as a part of the AH-64, will relentlessly seek out and destroy armored vehicles which are a major threat to ground forces. HELLFIRE will be the nemesis of the tank. It will leave enemy armor no place to hide.

The HELLFIRE missile (figure 2) is armed with a shaped charge warhead and is designed to accept a variety of follow-on seeker modules.

Figure 1



It offers a variety of employment options for maximum effectiveness under diversified conditions. The employment concepts for the HELLFIRE missile system with laser seeker are as depicted and each is addressed separately.

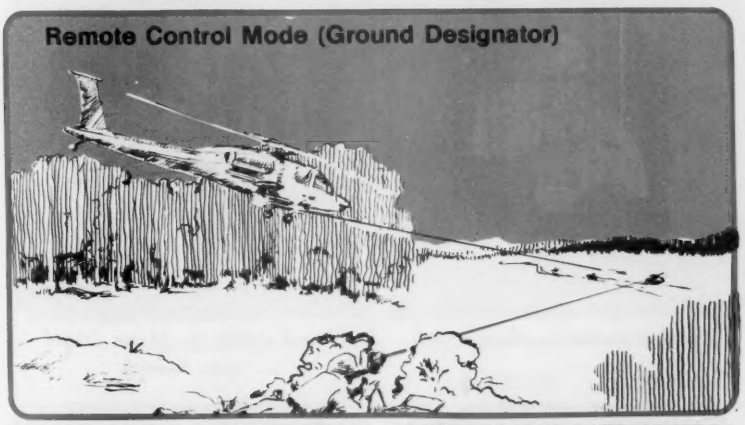
Remote Ground Or Scout Designator Mode: The *remote mode* provides the launch and leave capability for the AH-64. Targets are designated by a scout helicopter equipped with a laser designator or a forward observer using a ground laser locator designator (GLLD). Prior to unmasking, the AH-64 communicates with the remote designator to coordinate target location, launch method, firing technique, lock-on option, and start of designation, thereby reducing both designator and AH-64 exposure time. The AH-64 immediately remasks after launch and the remote designator illuminates the target during terminal homing.

HELLFIRE Modular Missile

↑Figure 2 Weight and length are for missile with longest and heaviest seeker

In the event a remote designator is not available, HELLFIRE can be fired in the *autonomous* mode. This mode provides for an airborne self-contained capability using the AH-64 fire control system to acquire and designate the target. However, in this mode the AH-64 must remain exposed throughout target acquisition, missile launch, target designation and missile impact (figure 3).

↓Figure 3

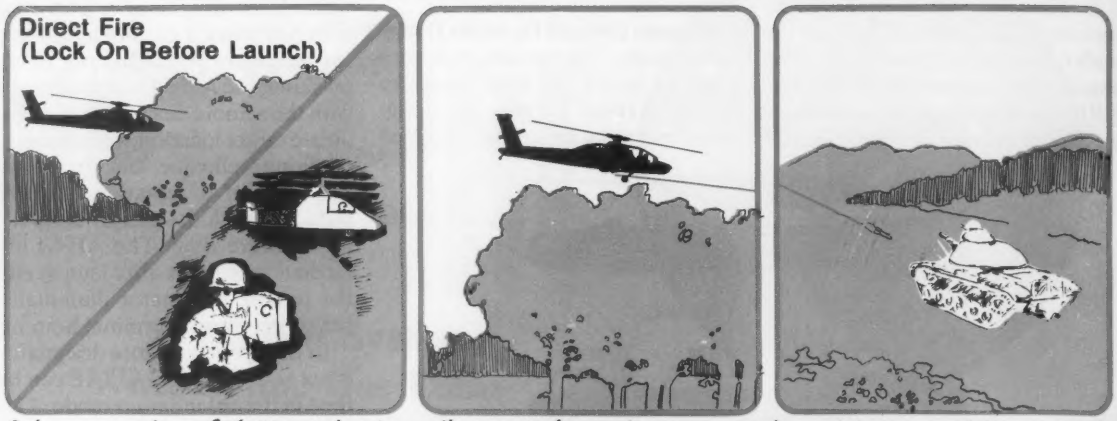


HELLFIRE includes both the *direct* and *indirect* launch methods. Direct fire launch can be employed using either a lock-on before (LOBL) or lock-on after (LOAL) seeker option. In the LOBL seeker option, the missile seeker locks onto the remotely designated target prior to launch (figure 4).

In the LOAL seeker option, the HELLFIRE missile can be launched on a trajectory toward the target with seeker lock-on occurring in flight (figure 5).

Using the indirect launch method, the AH-64 can eliminate totally the possibility of being detected by enemy radar. In this method the missile is fired while the helicopter is concealed behind masking terrain features such as trees or hills. A select switch on the fire control panel activates a preprogramed autopilot sequence to cause the missile to fly an elevated trajectory over the mask. The scanning seeker then locates and locks on the remotely designated target (figure 6).

An increase in firepower is achieved in either the remote or autonomous designation mode by employing the



Before unmasking AH-64 coordinates with remote designator (a Scout helicopter or ground designator)... *...unmasks and fires.. ..and then remasks*

Figure 4 ↑

AH-64 unmasks and fires directly toward target...

...target is remotely designated...

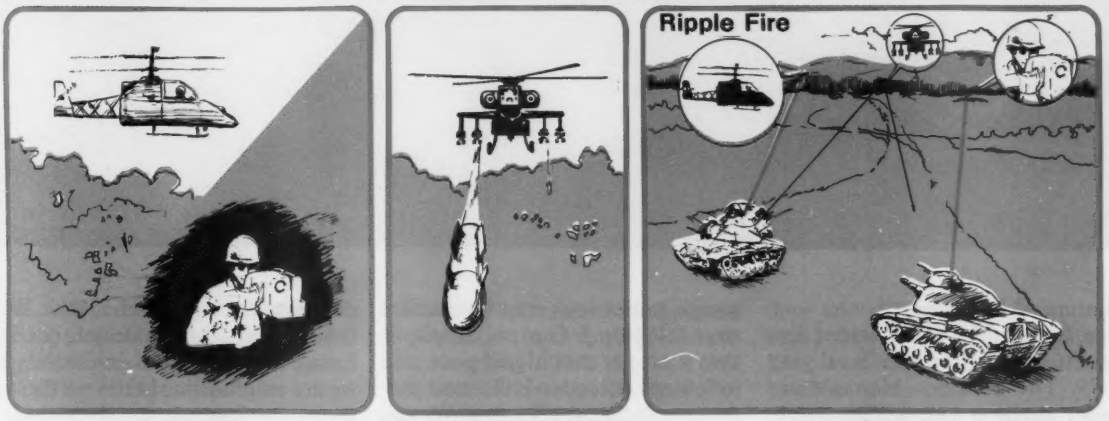
... and seeker locks on target after launch

Figure 5 ↑ Figure 6 ↓

AH-64 fires missile.. ..which is preprogramed to go over the mask.. ..and then seeker is locked on target

AH-64 fires a missile... *...after hitting the first target...* *...the designator slews to the next target*

Figure 7 ↑ Figure 8 ↓



When two designators are available... *...the attack helicopter fires missiles in succession...* *...and each designator illuminates its respective target*

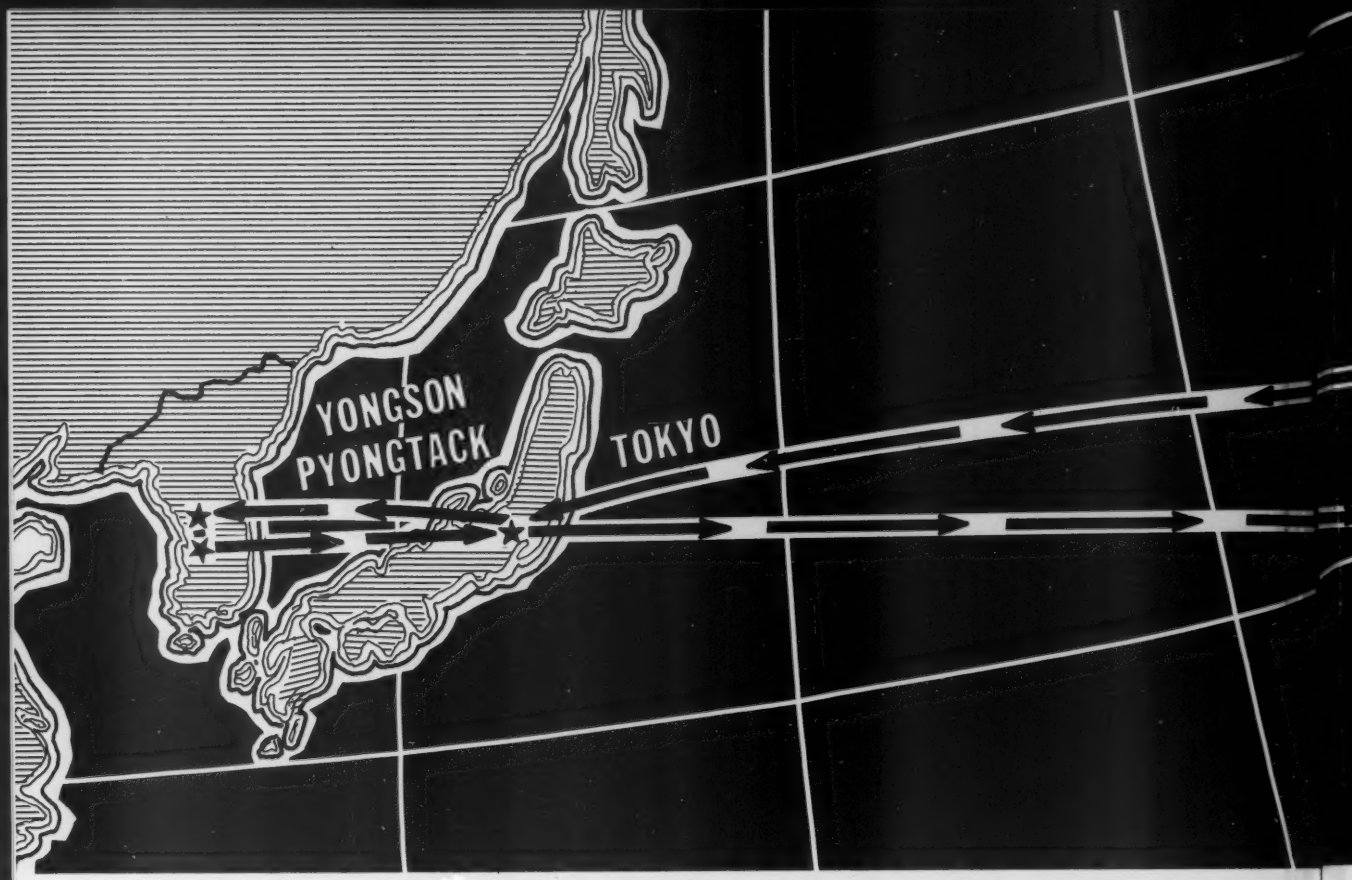
rapid fire technique. In this firing technique, multiple missiles are fired at intervals against multiple targets designated in succession. As a missile impacts each target, the designator slews to the next target (figure 7).

A further increase in firepower is available through the use of the *ripple fire* technique when multiple targets are to be serviced and multiple designators are available. Each designator operates on a separate code to illuminate its respective target. The AH-64 then launches multiple HELLFIRE missiles, one on each designator code—virtually one after the other (figure 8).

HELLFIRE has been designed for use by the troops in the field. It will be manufactured and issued as a "certified round," and requires no assembly or maintenance prior to employment. Its simple "Ram-Home Locking" feature not only expedites rearming, but also eliminates the hassle for personnel at night and during periods of inclement weather. Built-in test equipment of the AH-64 isolates faults to a line replaceable unit and eliminates tedious manual effort and guesswork.

HELLFIRE can do the job for which it was designed and will contribute significantly to the effectiveness of the combined arms team. Employed on the AH-64, it will destroy enemy armored vehicles and short range air defense weapons.

Its interchangeable follow-on guidance seeker modules on a common airframe make it effective equally around-the-clock and during periods of limited visibility. Its indirect fire capability make it possible to hit targets while the helicopter is protected by masking terrain. Its first-round accuracy and superior exchange ratios help the combined arms team beat the enemy to the punch.



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year. Skill level 5 will be tested during the same months in fiscal year 1979. The Soldier's Manuals are under revision and will be forthcoming in the near future.

Helicopter Maintenance Training (67N and 67V): Many of you expressed a desire for more hands-on training. This is now required by each student during each phase of maintenance training at the Aviation Center and each practical exercise has a hands-on examination which must be completed satisfactorily before a student is allowed to progress.

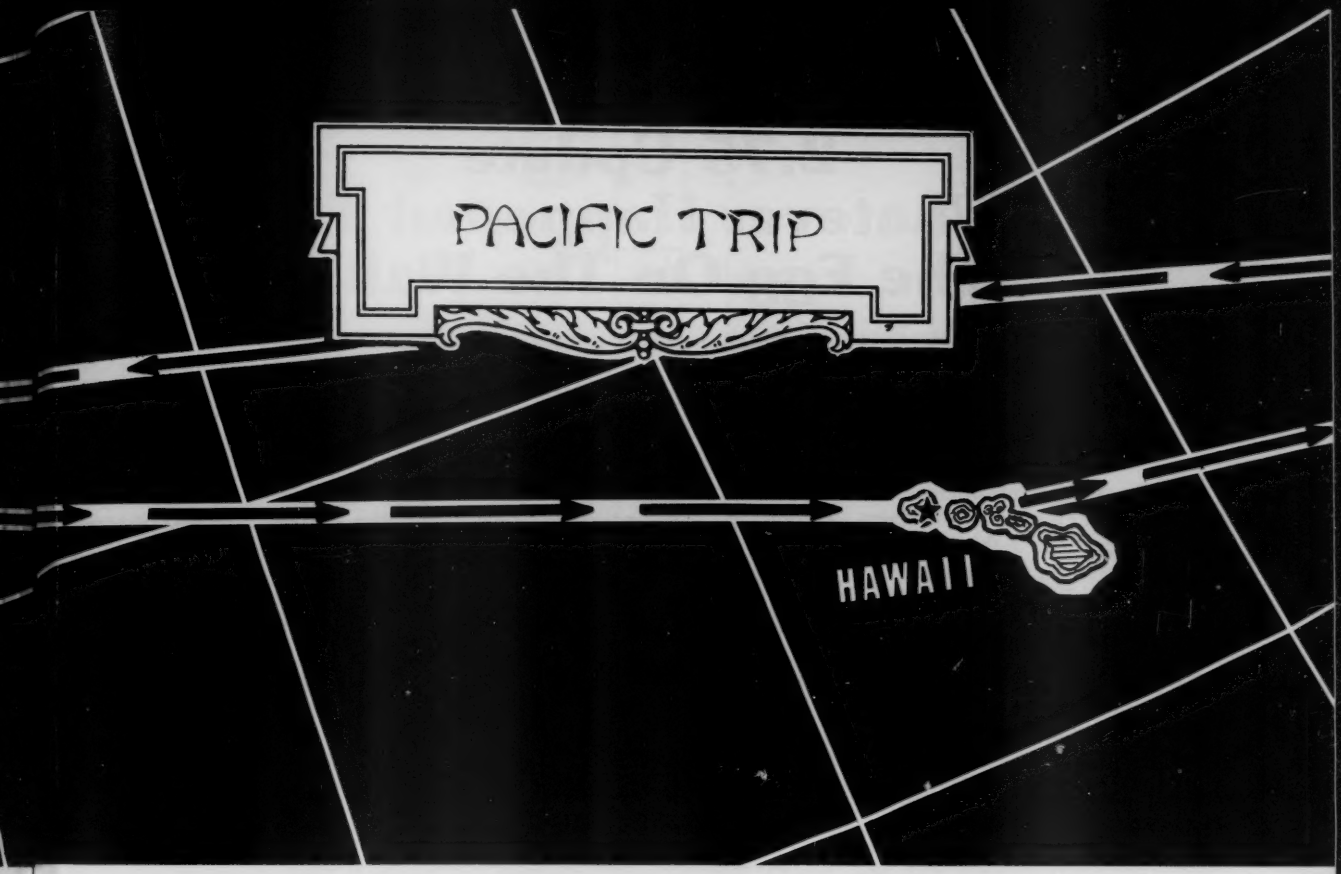
Phased maintenance was another point many people discussed with me. Phased maintenance is being taught for the UH-1 and in the Tech Inspectors Course. We plan implementation of phased maintenance on the UH-1 and OH-58 as the manuals are published for each aircraft in September 1978 and October 1978, respectively.

During the trip, I perceived that troops prefer lock-step instruction over self-paced. Our philosophy is that a proper mix of self-pace and lock-step instruction is the most productive and cost effective. We are working towards a better balance between these two methods.

Aviator Training: The Aviation Center implemented the 175/40 Initial Entry Rotary Wing (IERW) multitrack program last June (see November 1977 ***Digest,*** page 14). Our first class was graduated in March 1978 and although it is still too soon to draw precise conclusions, the 175/40 course is expected to provide better trained aviators than the previous program.

Many of you expressed dissatisfaction with the emphasis placed on aircraft preflight procedures taught at the school. First, it is a common practice for the field aviator to conduct a more detailed preflight inspection, and that's good. At the Aviation Center we emphasize preflight procedures in accordance with the —10 checklist. Because of limited available time during formal periods in academic training, we are emphasizing better preflights during the final, combat skills phase. All —10 checklists have undergone recent review and revision.

Night instrument flight and tactical instruments seemed to be on almost everyone's mind and I'm glad it is. We are doing a thorough review of our tactical instrument training program and I can assure it is going to receive greater emphasis in all flight training programs. We are planning toward requiring appropriate checkrides for FAA requirements to be only an interim step for completion of instrument qualification. Final instrument checkrides will include both FAA requirements and tactical procedures. Our analysis looks promising to improve the entire instrument program and should contribute eventually to a change in our approach to tactical instruments throughout



the Army. I recommend reading Major Gogolkiewicz' article, "TAC Instruments—Here We Go Again," in the April *Digest*.

Another area of great interest was the Aircrew Training Manuals. In March of this year, the Aviation Center hosted a proponent coordination meeting for the purpose of reviewing and revising all ATM task lists. The second generation of the manuals will be in the hands of field units by 1 September for implementation on 1 October 1978. Manuals will contain standardized task lists for each aircraft which include standards, conditions, and a description for each maneuver/task. In addition, the manuals will be in standardized format, include many provisions of the old TCs and contain provisions for commanders to compute unit training readiness at least partially based on aviator readiness levels. These computations along with appropriate ARTEP completions should provide commanders with a more comprehensive approach to readiness reporting. Provisions of the revised ATMs also will provide commanders greater flexibility and the basis for establishing annual training and flying hour programs. A new title: "Aviator Readiness and Training Manuals (ARTMs)" is being considered for the revised ATM.

There are other developments underway at the Aviation Center which will facilitate worldwide aviation training. For example, our current multitrack IERW (175/40) program provides two training tracks. All students complete 24 weeks of common training and starting the 25th week students will follow either the UH-1 track or the aeroscout (OH-58) track for the remaining 8 weeks. This program is being analyzed for further expansion to include two more tracks—AH-1 and CH-47. Another example of areas we are expanding and improving is in our Instructor Pilot Courses (IPC). We are analyzing and plan to consolidate and compress all IP courses into a one time, one shot systems IP course. More will come out later on these programs.

As I emphasized during my visit to your units, the Aviation Center is concerned about problems and requirements of troops and deployed units. Our goal at the Aviation Center is to develop and provide training and doctrine which fulfill aviation training requirements worldwide. The Aviation Center is doing everything in its power to ensure that you receive the latest doctrine and the highest quality training which, combined with the best equipment and top leadership, will enable us to support all commanders if war should come. You can help by reporting problem areas to representatives from the Center Team as they make regular field visits. Also, write to us at the Aviation Center with any ideas that you feel will improve any aspect of our readiness posture.

2.75 Update
Whatever Happened To "The Egg On The Wall"?

Colonel James L. Tow
Project Manager
2.75 Inch Rocket System
Redstone Arsenal, AL

A FEW years ago my predecessor, Brigadier General Frank (Rags) Ragano, described in this magazine a new lethal warhead, the Multipurpose Submunition (MPSM) Warhead. Its functioning characteristic was likened to that of a raw egg thrown against a wall. (See "Zee Egg Versus Zee Tank," May 1975 *Digest*).

By means of these written words I am pleased to present to you an update on this and other 2.75 inch rocket system improvements.

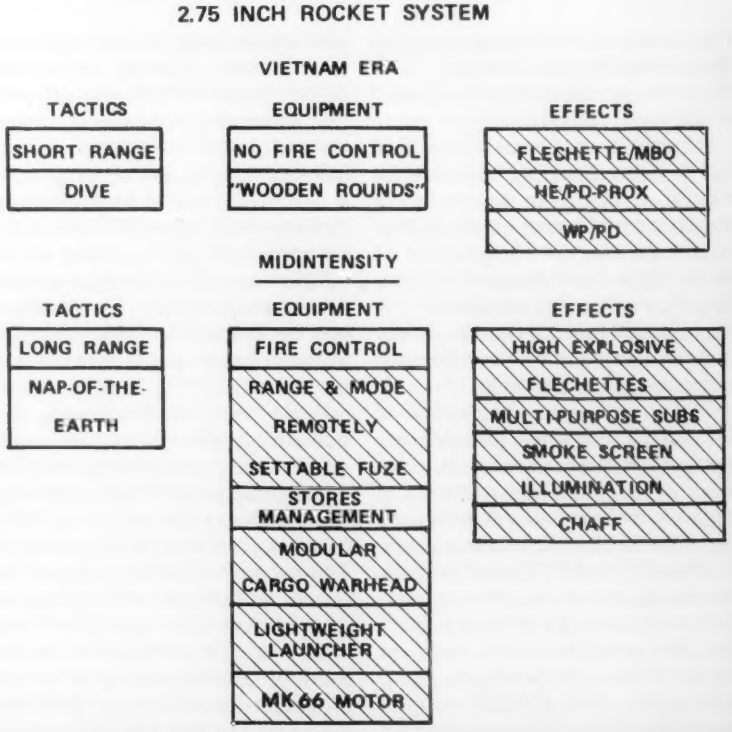
My subject separates nicely into several general categories: those improvements on the aircraft that are going to contribute to better rocketry; improvements in system lethality; progress with our nonlethal or supporting warheads; improvements which increase system range and reduce its weight; and finally, some "off-the-wall" warhead concepts for your consideration.

Improvements To Better Rocketry. First then, a look at the aircraft system improvements to rockets. Very briefly and perhaps in review, the rocket related tactics, equipment and effects we had in Vietnam are known to most of you. As we looked to mid-intensity, the Army rapidly identified and developed new tactics and doctrine. The complementing new equipment takes a little longer; nonetheless, much work is being done in this regard and that's what this article is all about. The effects that come from this equipment, of course, are the type that have been identified as being necessary to fight and win in that mid-intensity environment. They were supported by Training and Doctrine Command's Pass In Review Study (see "Pass In Review," April 1975 *Digest,* and "The Up-Gun Dilemma," May 1975 *Digest*) and by the Selected Effects Armament System (SEAS) Cost and Operational Effectiveness Analysis (see "SEAS COEA," April 1975 *Digest*).

Shown in shaded boxes of figure 1 are those areas for which the 2.75 inch rocket system project office has responsibility, and under the equipment category that means the fuze, the warhead, the motor and the launcher. The fire control and stores management are responsibilities that fall under the purview of the aircraft project manager; but let me touch on them briefly as to what they mean to the rocket system.

First, the *fire control.* The critical part of fire control is the laser rangefinder which will correct the massive problem related to a 25 percent range estimation error which is experienced

1. Comparative Use Of 2.75 Rocket System

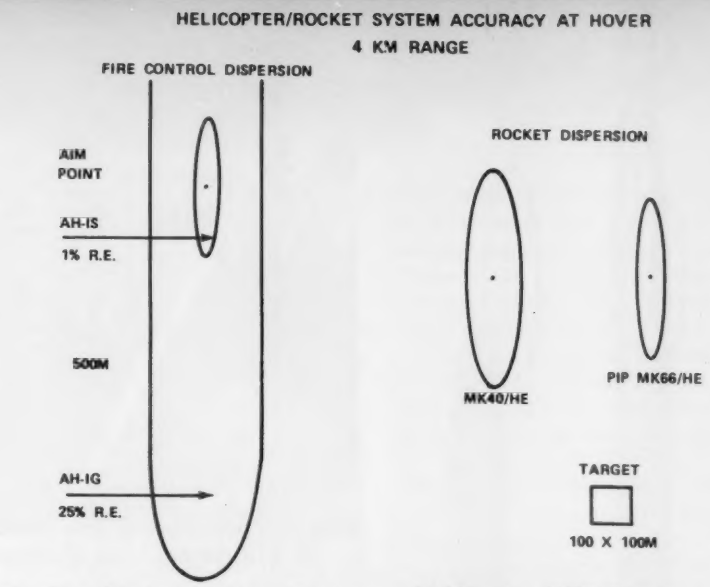


with our human system and bring it down to 1 percent (figure 2). This means that the aim point variation due to this range error will be drastically reduced in size. In terms of the traditional ellipse pattern we will see an 80 percent reduction in the aim point variation. The current Mark 40 Motor has a ripple ballistic pattern of some 19 mils. With the existing range error combined with the rocket ballistic characteristics, it's not surprising that one gets the large inaccuracies that many know so well. Unfortunately, and all too often, the wide spread knowledge of these inaccuracies provides the basis by which many improperly judge the worth of ongoing system improvements. It is readily seen that a significant improvement will result just by eliminating the current range estimation error, and this the fire control will do. You will start to see fire control in AH-1 Cobras in the latter part of 1979.

The second area I would like to mention relates to *stores management and fuze setting*. On a cockpit panel similar to the one of figure 3, pilots will be able to choose the type of warhead they want to fire by selecting the zone within the launchers from which it is to come. They will apply the fuze setting that they want for the rocket depending upon its purpose and they will select the quantity to be fired. Pilots also will be able to set the rate of firing and, as you can see from the panel, much other information will be available to them, all key benefits.

One point further about stores management and the zone from which a rocket will come: in our current launchers, we don't have such a capability, but in the future, the Lightweight 7-Tube Launcher will have two zones, one consisting of three tubes and the other of four.

Moving to the 19-Tube Launcher, these same zones are retained within the center seven tubes, but, a third zone of 12 rockets is added with the outer ring. Fuze setters and stores management will begin appearing



2. Fire Control System Accuracy At Hover—4KM Range

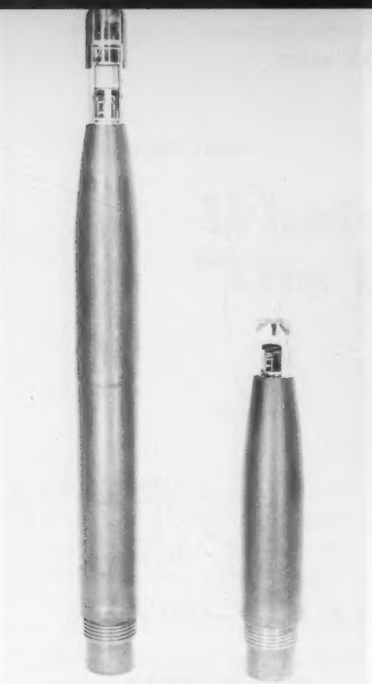
on our AH-1 Cobras around the end of this year.

Lethal Warhead Improvements. I would like now to move into the specific improvements for which I am responsible, dealing first with those related to improvements to our lethal warheads.

Two old friends are still in our inventory, the M229 17-pound Warhead and the M151 10-pound high explosive (HE) Warhead (figure 4). Fuzes available are proximity and point detonating. Well, what are we doing to these old friends? We are adding the new remotely set M433 multioption fuze (figure 5). With it, inflight and from the cockpit, the pilot then can select a super quick mode or two variations in delay; one is related to tree height for a forested target area and the other is the delay necessary to achieve a penetration through a bunker or building. The M433 fuze should very much enhance the utility of the HE Warhead. With availability dependent upon the allocation of procurement funds, this new warhead is scheduled to become available during 1980.

The other fuze of the remotely set family is the M439 fuze (figure 6). It is settable in terms of range, either manually dialed from the cockpit in 100-meter increments, or automatically set from the rangefinder input to the fire control com-

3. Cockpit Fuze Set Panel



4. M-229 Warhead (L) And M-151 (R)

5. M-433 Remote Set Multioption Fuze/2.75 HE Warhead

puter and then through the fuze setter electrically to the rocket warhead. This means that the aircraft from a given firing position will be capable of engaging several different targets at differing ranges with different warheads, all without moving the aircraft.

With the performance of this fuze kept in mind, I would next like to describe the most impressive of the new developments, the MPSM Warhead. It is the warhead to which the "egg on the wall" concept applies. The concept is alive and technically very well. Shown in figure 7 in cutaway, this warhead will have 9 submunitions stacked as shown. Using variable range feature of the M439 fuze they will be expelled at a selected point along the trajectory. Each submunition is multipurpose in that it is effective against personnel, materiel and armor. The submunition has a high drag device such that when each is expelled from the warhead it is, in short order, reduced in velocity and separated from others, achieving a vertical orientation as it falls to the ground.

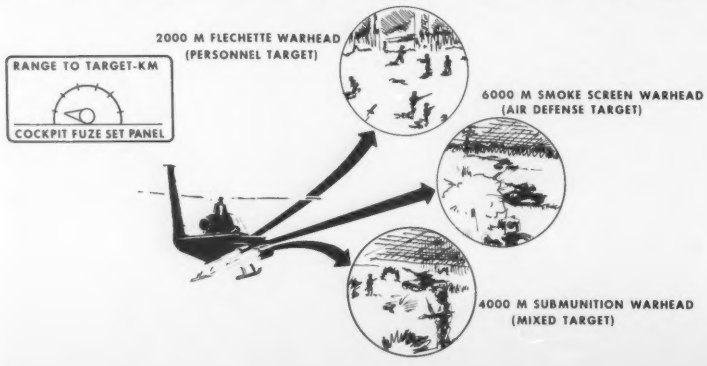
As determined by the Army Materiel System Analysis Agency, (AMSAA) effectiveness against prone personnel is particularly impressive. Each warhead has five times more lethal area than the standard 10-pound warhead. Significant results also are obtained against materiel and penetration of armor is achieved from the shaped charge that is within each submunition. Given hits, very significant probabilities of kill are obtained against point targets of armor. Consequently, while the MPSM Warhead is not designed to be an antiarmor type weapon, it nonetheless carries with it a lethality that could not comfortably be ignored by an enemy.

How have we done in tests to date? During the spring of last year at Yuma Proving Ground, AZ the air launched phase of DT I Tests was conducted. Most of the impact data are described by figure 8. Notice the 250 meters by 350 meters pattern, the direction of fire, and the fact that AH-1G was standing off 2,500 meters.

For reasons of economy during the advanced development phase, only seven submunitions were contained in each warhead. Shown are the results of 32 warheads, fired from a hover or 20 knots (kts) single or in pairs. A new sight alignment was assumed prior to each single or pair firing. Firing from a hover was performed intentionally with sight settings of both 39 and 129 mils. We wanted to confirm that variations of pitch attitude normally unintentional, did not significantly affect the pattern's location; and indeed we found that to be consistently true.

The final firing of eight warheads was with 20 kts forward flight, firing singles. This was done by eight consecutive passes over the firing point at that same speed and while the

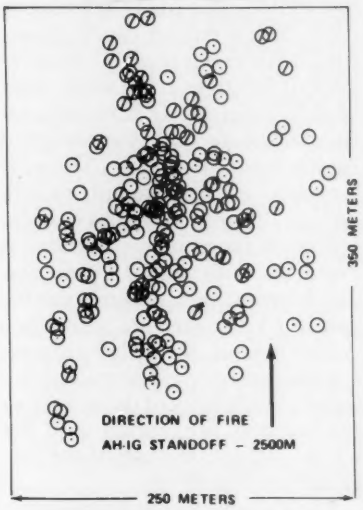
6. M-439 Range Remote Set Fuze/2.75 Cannister Warhead



7. XM-261
MPSM Warhead

sight setting was 83 mils. We did have unintentional variations in pitch attitude; nonetheless, the impact area and pattern remained essentially unchanged from that of warheads fired from the hover. The findings are more significant and clearly show a vast improvement in tightening up of the impact pattern over that which we expect today with the standard 10-pound HE Warheads.

Now what does this mean in terms of effectiveness? Available analyses tell us that today with 38 rockets fired on 100-square meter prone personnel target at 4,000 meters (with our current AH-1G, 25 percent range error, and Standard HE Warhead), we could do little more than frighten the enemy. However, with the Submunition Warhead combined with the fire control now being developed for the Cobra, the casualties would exceed any and all expectations.



#WHDS	AIR SPEED	TYPE FIRE	SITE SETTING
8	HOVER	SINGLES	39 MILS
8	HOVER	PAIRS	39 MILS
8	HOVER	SINGLES	128 MILS
8	20 KTS	SINGLES	83 MILS

8. DT-1 Results (Air Launched)

There is every reason to be optimistic about what to expect from this high payoff warhead. Tests show that we have an acceptable item already from the standpoint of lethal area and armor penetration. Pitch variation sensitivity virtually has been eliminated because of the excellent performance of the high-drag device of the submunition. We officially completed advanced development in October of 1977 and progress in fiscal year (FY) 78 is dependent upon the extent to which funding can be identified.

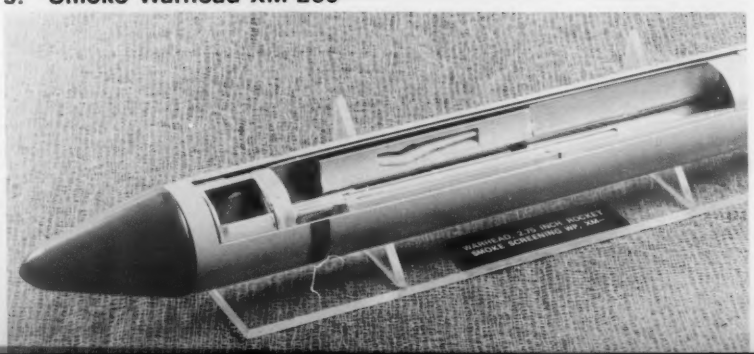
Supporting Warheads. Turning now to the supporting type warheads, the first one that I would mention is the Screening Smoke "Wick" Warhead. Shown in figure 9 in cut-away is the new warhead. It has 10 perforated metallic "wicks" filled with fiberglass which are contained in a canister filled with white phosphorus. When the warhead functions the canister bursts, creating a cloud of white phosphorus in the air, with the 10 wicks streaming individually to the ground. One would see the trail they cause for about 5 minutes. These wicks provide a continuing source of smoke, thereby creating a very effective smoke screen.

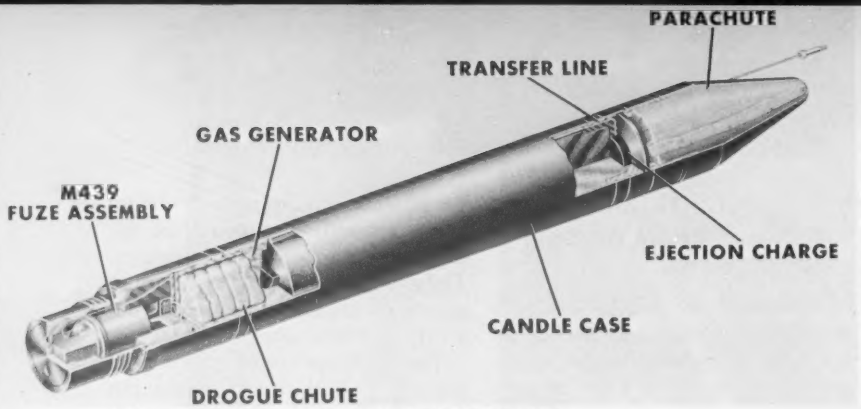
Two different configurations will provide for both fixed and variable range fuzing. The fixed distance smoke as demonstrated during DT/OT I could be available in 14 months. This period reflects the time needed to obtain the money, administer a contract, and then produce the warhead. A special in-process review (IPR) was held in September which recommended that the warhead be type classified; thus, it will be cleared soon for an urgent procurement to meet contingency and training needs. Procurement is planned for FY 79.

With respect to the preferred Smoke Warhead, the remotely set fuzed variable range version, we have just completed a year of inactivity due to a lack of dollars, but engineering development will now start in earnest in FY 78 with fielding planned soon thereafter.

Many valuable lessons should follow the fielding of a Smoke Screening Warhead. There are differing opinions as to the use of Smoke Warheads from attack helicopters capable of carrying antitank missiles. Some believe that missiles must make up the total wing store load, but I strongly believe that if it has not already arrived, the day will come soon when the firing of smoke in support of tank killing missions is as much a part, one with the other, as fires are to maneuver and that

9. Smoke Warhead XM-259





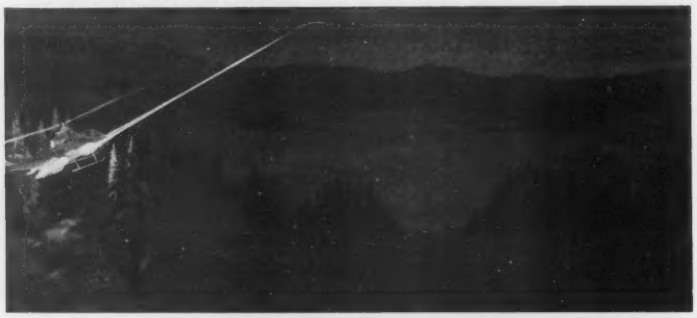
10. Illumination Warhead XM-262/263

habitually, some of the attack helicopters assets will always fire smoke and other supportive suppressive fires while the balance of the force engages tanks with its missiles. This view is not widely held.

It might be useful to ponder some key questions with regard to smoke for aviation; for instance, who delivers it? When and how is it employed? If the answers to these questions require rocket delivery of smoke, we will need to train for this role. Hopefully, the imminent type classification action will clear the way for a procurement so attack helicopter units can get on with this important training task.

The Illumination Warhead is another one that we are working on. Shown in figure 10 as a cut-away, it will ultimately use the same variable range fuze that I have already described. In concept, the expected use of the Illumination Warhead is shown in figure 11. First, we see an aircraft firing illumination into the darkness, toward a suspected target area. By the illumination provided, targets are illuminated and then subsequently engaged by either ground antitank weapons or from the aircraft firing tube-launched, optically-tracked, wire-guided (TOW) or Helicopter Launched Fire and Forget (HELLFIRE).

11. Illumination Warhead Firing

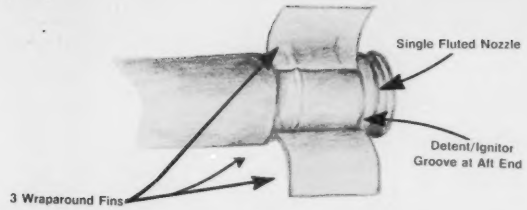


Enemy Returns Fire. Attack Helicopter Repositions Self

Helicopter Attacks Illuminated Targets With TOW Or HELLFIRE

What's the status today? As you are probably aware, there is a current Standard M257 Illumination Warhead which we are now procuring for the first time. In fact, a recently signed contract with Thiocol will provide for 50,000 illumination rockets. The first of this quantity should reach the field around the end of 1978. The M257 will provide more than a million candle power for 2 minutes but there is one drawback. It functions at the single range of 3,000 meters. This means that the parachute flare was designed for low ejection velocity. The need for variable ranges requires a new design development, hence the follow-on illumination warhead is essential. With regard to the new development item, progress was begun in FY 76, then stopped when dollars ran out. No further progress has been made or will be made pending the availability of dollars. They are not now programed until the FY 80 budget because of the low priority of the effort.

The Variable Range Illumination Warhead will have the same performance as the M257 in terms of illumination and duration but it will incorporate the fuze which can be manually or automatically set from the cockpit for the desired range. It will be designed for the variable



MK66 MOD O Motor

MK66 MOD 1 Development Goals:
- **Retain MK66 MOD O Performance**
- **Redesign Fin And Nozzle**
- **Increase Spin To Achieve 7-9 Mil Accuracy At Hover**
- **Relocate Detent/Ignitor Contact For Launcher Compatibility**

12. Mark 66 MOD 1 Tri-service Motor

velocities that the parachute would experience at the near and far ranges. Because of our delay in getting started it may not be available for some 5 to 6 years.

Less Weight And Greater Range. Next, I would like to address the system improvements which brighten the picture regarding system range and weight; first the range improvement. In FY 78 we have begun the development work necessary to introduce the Navy-developed Mark 66 higher velocity rocket motor into the Army and eventually Tri-Service inventory. In view of the goal to maintain interoperability with North Atlantic Treaty Organization (NATO) launchers, I am confident we will see it there too (see figure 12).

The Army has decided that it wants the Mark 66 because of its higher velocity, which in turn gives us a direct fire range capability to 6,000 meters; this is about a 2,000-meter improvement over that of the Mark 40. While we want to retain the velocity characteristics of the Mark 66, its current design in the fin and nozzle area and of the electrical contact are incompatible with current Tri-Service launchers.

Our program will address the compatibility problem and, at the same time, incorporate into the fin and nozzle area the best known design concepts for achieving an improved ballistic accuracy when rockets are fired from a hovering helicopter. By focusing on fin and nozzle redesign, we can expect a motor which is less sensitive to the very difficult downwash environment. From this program should come tighter patterns, greater range and higher velocity.

The Lightweight Launcher (LWL) is under development by Hughes Aircraft Company. One of the latest prototypes is shown in figure 13. This launcher is quite different from what we have today. The 19-tube launcher is expected to weigh 80 pounds; that is nearly 65 pounds lighter than one of our current launchers when modified for remote fuze setting. The 7-tube launcher will weigh under 40 pounds. The launchers will be capable of eight or more firings per tube. Today's M200 Launcher is reusable, many more than eight times, and is repairable. The LWL will incorporate the wiring for the remote fuze setting and also will have the provisions for environmental protection of the rockets so that they can be fired under flight conditions of moderate icing. There are a number of improvements to be found in the new "Lightweight Launcher." Deliveries are expected during the last half of 1979.

In this article, I have tried to present the latest status of our funded rocket system improvements. Recognizing that some of what I have written may spark a response, this author invites the comments and/or inquiries from your readers. I appreciate fully that ideas of value can come from anyone within our broad base of rocket users and supporters.

Whether or not you have comments or ideas regarding the 2.75 inch rocket system, you can be certain of one thing—it is a totally new system which is coming with capabilities so vastly improved over what we now have—you may have to see it to believe it. And see it you will!

13. New, 19-Tube Lightweight Launcher

"WE CAN NO LONGER CHASE THE FOUR WINDS"

THE JOB OF investigating aircraft accidents has always belonged to the unit having the accident. This meant doing the investigation, preparing the report and coming up with corrective actions to prevent similar mishaps. On the first of April all of this changed. Under a new concept called Centralized Accident Investigation, or CAI, the United States Army Agency for Aviation Safety (USAAAVS) is investigating on a trial basis all major and selected minor accidents worldwide. To find out how CAI will work, we decided to interview Colonel Keith J. Rynott, USAAAVS commander.

Digest: Why was CAI needed?

COL Rynott: There were several reasons. The need first became apparent when we developed a procedure to analyze accidents to identify inadequacies in the aviation system that allowed or caused the accident to happen rather than looking at single occurrences. This approach identified inadequacies and remedies which could be presented to decision-makers at the systems level of the Army. After analyzing two years of accident data, it became apparent that we needed to improve our source data, the investigation report, because an excessive amount of time and manpower was required to analyze the information we were getting.

Another reason was the situation which developed concerning our assistance visit program. For years USAAAVS was the only agency providing on-site assistance to field units to help them in their accident prevention programs. However, in 1975 each major command was tasked to come up with a resource management team to perform essentially the same duties we were performing during our assistance visits. So we had a duplication of effort. We felt that we could better redirect our resources out of the assistance visit business and into something we thought would give us a higher payoff, and that was professional, timely and responsive accident investigation.

These reasons, along with the need for better and more timely data for our analytical system, led us to look for a better way to conduct accident investigations.

Digest: What are the advantages of CAI over field investigations?

COL Rynott: First, there are few professional investigators in the field. We are looking for professional investigations by professional investigators. Many aviators never become involved in an accident investigation and I would say that only a few have ever been involved in more than one investigation. The difference is experience and we have that experience at USAAAVS.

Secondly, we are looking for continuity in our investigations. With the same people investigating accidents, we can build up some continuity and some institutional memory.

Thirdly, CAI is more timely and responsive. For example, on an investigation we recently conducted, we completed the field work, report and analysis, cranked the information into our data base, and were working on countermeasures within 30 calendar days after the accident.

The field is allowed 15 working days to give us a direct copy of an accident report and it's rare that this deadline is met. Then they have 40 working days to get in the channel copy of the report. That's the copy which goes up through the chain of command for review and approval. Divide this by five and you're talking about 8 weeks or 50 to 60 days. Again, this deadline is seldom met. So the information in the accident report is between 2 and 3 months old before we get it for analysis. Then, if the report is not complete or does not meet our data requirements, we must go back to the field for additional information. We then find it very difficult to reconstitute the board and get the needed information. CAI will give us a timely report and therefore earlier detection of Army-wide trends and problems.

With the same people doing all the investigations we are going to get quality in our reports—quality that will go into our analysis system. And we will have the report 30 to 60 days sooner.

The greatest advantage of CAI is that a single organization will be responsible for investigating the accident, acquiring and recording the information, performing the analysis and developing countermeasures. But I want to stress that the CAI concept will be on trial for an indefinite period of time. While we do not know all the things this system holds in store for us, I think we're going to find that the benefits will far exceed what we expect right now.

Digest: What will determine whether or not CAI continues on a permanent basis?

COL Rynott: We will have to look at the dollars and the resources expended during the trial period and see what we got for our money. I think it will take an extended period to get the data we need to compare the results of CAI reporting and analysis with previous experience to see if, in fact, CAI produced all the things we anticipated. In other words, is CAI meeting the needs of our Agency and, foremost and uppermost, is it meeting the Army's needs? If it does not meet the needs of the Army and the local commander, then, of course, we will have to look for another way.

Right now our accident rate is at an all-time low, around 6 accidents per 100,000 flying hours. Fifteen years ago we had 26 or 27 accidents per 100,000 flying hours. So instead of cutting down trees in the forest, today we are grubbing stumps. Our analysis procedure demands the best data we can get. It must be timely and complete. If we find there is no great difference between our CAI product and that provided by field investigations, then we will end up somewhere in between.

Digest: Will CAI be a more expensive operation than field investigations?

COL Rynott: No, CAI will not be more expensive, mainly because of improved efficiency. I think our investigators will be able to do the investigation quicker, and unit people participating in the investigation will get back to duty sooner than they would have had they been conducting the investigation alone. The only real difference is travel to and from the accident site. However, 60 percent of the accidents for the past 5 years occurred within 3 to 4 hours' C-12 or U-21 flight time from Fort Rucker. So, we are only talking about what it takes to load the team in one of our airplanes, take them to the unit, drop them off, support them while they are there, and bring them back.

Most accidents occur within the proximity of Army installations, so our people will stay on post. This same support has to be provided regardless of who does the accident investigation, so there's no additional expense there.

We are offsetting the travel expense by trading off those man-days we would have used for our assistance visits. For the trial period, we are going to discontinue the assistance visits and use those resources, both personnel and funding, to conduct the CAI program. Now we don't expect to be out of the assistance visit business forever. I think we need to evaluate the major commands' accident prevention programs.

Digest: So the assistance visit program is not dead?

COL Rynott: No, it's not dead. But when we start these visits again, they will have a different thrust. They will be targeted more at the management of the accident prevention program than at the implementation of the program. We will do a stovepipe evaluation within a MACOM. That is, we will take a random sampling of units and trace their programs up through the intermediate headquarters, finally ending up at the MACOM where we will give a good evaluation and report on how well we feel their accident prevention program is working.

Digest: Is the unit having the acci-

"The greatest advantage of CAI is that a single organization will be responsible for investigating the accident, acquiring and recording the information, performing the analysis and developing countermeasures."

dent now relieved of all responsibility for investigation?

COL Rynott: No, not at all. Our teams will be composed of a board president, a recorder, and probably one air safety specialist or technician, a civilian with expertise in the particular type of accident we are dealing with. We will tailor the teams as needed. If there is a lot of medical interest we will dispatch our flight surgeon. If there's a need for human factors expertise then we will send a human factors guy out with the team, or he may later augment the team, as appropriate.

At the time we are notified of an accident, we will advise the field that we would like an SIP in the type, model, and series of aircraft involved in the accident and possibly a maintenance officer. The field unit will always have representation on the board and they will still have to provide the same support as in the past. When we arrive at the crash site, we will take over the responsibility for the investigation and for preparing the report. We will come equipped to do the investigation. However, the unit will have to provide personnel to search for lost parts, crate and ship exhibits for teardown analysis, remove the aircraft from the crash site and dispose of it. These jobs still belong to the installation.

Digest: What part does the unit ASO play in the investigation?

COL Rynott: The ASO will really be the coordinator between our team and the unit. He will be the point of contact to the board. We will exploit to the fullest his knowledge of the particular area, the unit, and its mission.

Digest: How quickly will CAI teams be dispatched after notification of an accident?

COL Rynott: We have a CAI operations center which is manned 24 hours a day, 7 days a week. We are committed to dispatching a team from Fort Rucker within 2 hours of accident notification. We have a go team and a standby team on call at all times. When they are at work, their luggage is with them. The aircraft crew is on alert and the aircraft is preflighted and ready to go. When the go team is sent out, the standby team becomes the go team and the next team becomes standby. We have six full-time teams. If all of these are out at one time, we have three surge teams that will move up. We currently have a C-12 and a U-21 and as I mentioned earlier, 60 percent of all accidents occur within a 4-hour C-12 or U-21 radius of Fort Rucker. Soon we are going to have good overseas connections out of Atlanta with direct flights to Europe. So we don't see any big problem in getting to the accident site.

Digest: The accident report is finalized after the CAI team returns to USAAAVS. If additional information or a change in the findings is required, how will the unit members who served on the board be able to participate?

COL Rynott: Well, there could be a lot of telephone communication. But I don't anticipate any drastic or radical changes in the findings and conclusions the team arrived at before it left the unit. I think they will have found the "what" in the system that allowed the accident to happen at the installation level. When the team returns, they will be looking at remedies to inadequacies in the total Army aviation system, not just something to correct at installation level.

Now this is the beauty of CAI. Once our team comes home, we can tap the expertise not only in USAAAVS, but also all the expertise at the Aviation Center. We will have the benefit of instructor pilots with 6,000, 8,000, 10,000 hours in the particular aircraft in question and all the people we work with regularly at the Directorate of Evaluation and Standardization. We can get their help in preventing a particular type

". . . we're all in green suits; we're all in the Army and we're trying for the same things the guy in the field is trying for—more operational readiness and greater combat effectiveness."

"Right now our accident rate is at an all-time low, around 6 accidents per 100,000 flying hours. Fifteen years ago we had 26 or 27 accidents per 100,000 hours. So instead of cutting down trees in the forest, today we are grubbing stumps. Our analysis procedure demands the best data we can get."

of accident. If changes are made, unit board members will be kept up to speed and the report will be sent to them. They will have to review it because if they don't agree with it something will have to be worked out. If they do agree, the report will then be sent through normal Army channels as always.

Digest: Will unit commanders be briefed before your team leaves the accident site?

COL Rynott: Yes. The responsible officers in the chain of command will be briefed on the tentative findings, conclusions and recommendations. The commander will be given progress reports as the investigation goes along. We have no secrets. We are there to prevent accidents, to assist the commander in determining as accurately as possible what caused the accident and how to prevent similar accidents in the future. So we see no problem in keeping the unit commander informed as to what is going on. If there is something that we think should be taken care of immediately, we will tell the commander at the time so he can take whatever action he deems appropriate.

Digest: Are the Navy and Air Force investigation programs similar to CAI?

COL Rynott: No, they aren't. This subject was brought up by the Air Force at the Joint Services Aviation Safety Conference at Norton Air Force Base last September. Both the Army and Air Force presented their accident investigation concepts at that time. The Air Force system places responsibility for accident investigation at the major command level rather than at the installation level as does the Army. On the first of January this year, the Air Force safety people started a limited test program using professional mishap investigation teams to investigate selected accidents. The last time we talked with the Air Force, they had been out on one investigation since the first of the year. I believe they would like to do more in the investigation business, but they're somewhat constrained by resources. If I recall correctly, Navy investigations are conducted by the squadron having the accident and the report is then sent up through the chain of command.

Digest: What do you think the payoff from the CAI program will be?

COL Rynott: CAI is new and different. Often, we are suspicious and not completely at ease with things that are new and different, things requiring drastic changes. We know that the job ahead will not be easy. We are going to be under the gun to produce a professional investigation based on facts. The effectiveness of the prevention effort is completely dependent upon the quality of the investigation and report and a sound analysis so that effective countermeasures can be developed.

"... we want to reduce the number of accidents which have only suspected causes. Suspected causes don't allow us to do much about preventing accidents."

We cannot chase the four winds in trying to prevent accidents. We have to identify and concentrate on those accidents we know are going to happen over and over and that we can do something about. The effectiveness of this effort is based on the quality of the accident investigation and report. We have found that the quality of past reporting, although good, did not meet our total needs. Timely reporting is vital to prompt identification of problems and prompt development of corrective actions.

Foremost, we want to reduce the number of accidents which have only suspected causes. Suspected causes don't allow us to do much about preventing accidents. I have great optimism that CAI will reduce the number of accident investigations ending with suspected causes.

There are just so many advantages to the program. I have been out on training exercises which came to a grinding halt because of an aircraft accident. Or else I was plucked away from my duties to investigate an accident. I feel that CAI will provide a real service to the field. When a unit has an accident they can just pick up the phone and we'll relieve them of the investigation burden, at least the management part of it.

Sure, we're still going to need some expertise from the local unit. But we're all in green suits; we're all in the Army and we're trying for the same things the guy in the field is trying for—more operational readiness and greater combat effectiveness. CAI is just another way to achieve this goal and we will achieve it together by accurately determining accident causes and then coming up with real remedies.

Digest: Thank you, COL Rynott.

Directorate of Evaluation/Standardization

REPORT TO THE FIELD

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362; or call us at AUTOVON 558-3617 or commercial 205—255-3617. After duty hours call AUTOVON 558-6487 or commercial 205—255-6487 and leave a message

The Directorate of Evaluation and Standardization (DES) beginning this month is back in the *Aviation Digest*. Each month the *Digest* will contain items of interest from DES in a report to the field. Subject matter will come from information gained during DES' Evaluation and Assistance Visits to various aviation units Armywide and areas identified through the directorate's mission.

The directorate as organized at Ft. Rucker, AL has the mission of evaluating the training program at the Aviation Center. DES constantly receives important information from the field. This provides a data base which assists in determining the adequacy of the Ft. Rucker graduates and the training they received. The standardization mission supports both the Aviation Center and aviation in the field through evaluations, augmenting major command aviation survey teams and assistance visits. We'll discuss what happens when DES goes on a trip in a future issue of *Aviation Digest*.

RECENT WORLDWIDE evaluations of Active duty and Reserve component aviation elements have revealed that Army aviators are aware of operating limitations imposed upon them by center of gravity (CG) limitations. But a problem area arises in that many aviators are not familiar with how to compute correctly a DD Form 365F, Weight and Balance Clearance Form. For example, in a UH-1H when flying at an aft CG (Station 140 to 144), the approach must be terminated at a minimum of 5-foot hover to prevent striking the tail on the ground. Knowing this limitation is commendable, but how do aviators know when to terminate their approach at a 5-foot hover or continue the approach to the ground? If computed properly, the DD Form 365F can answer this and other pertinent questions related to weight and balance.

The safe operation of an aircraft is dependent upon many factors; one of these is the aviator's ability to ensure the aircraft is operated within specific weight and balance parameters. In order to avoid hazardous flight conditions associated with CG limits, the unit training program should be tailored to present that information necessary to compute accurately the DD Form 365F for loading the specific aircraft assigned.

In addition, all aviators should be familiar with the basic forms and publications used to establish the weight and balance record. The necessary publications include TM 55-405-9, that defines the principles of weight and balance and gives general information; AR 95-16, which provides a weight and balance control system for all operational Army aircraft to ensure aircraft safe flight within their respective design limitations; and the appropriate −10, −20 and −35 maintenance manuals. The appropriate forms are DD Forms 365, 365A, B, C, F and Chart E.

DD Forms 365 and 365A provide a listing of the weight and balance technicians and a basic weight checklist, respectively. The DD Form 365A (Chart A) lists that equipment which is, or may be, installed in the aircraft. In addition, it provides the basic weight, arm and moment for use in correcting the

DD Form 365C. The actual weighing data is compiled on the DD Form 365B, calculated for various inclusions or exclusions, then entered on the DD Form 365C. This information, the basic weight and moment, establishes the foundation for the continuous history of adjustments made to the aircraft with the last entry on the DD Form 365C representing the most current weight and balance status of the aircraft. With this data and the Chart E, found in the appropriate Operator's Manual, the aviator or unit weight and balance technician can successfully compute the DD Form 365F clearance form. Correct computation of the DD Form 365F provides the operator with the necessary information to ensure the aircraft is loaded properly within its design capabilities.

Commanding officers of units operating, maintaining, repairing or modifying Army aircraft must ensure that all assigned aviators are complying with current weight and balance directives. However, it is the responsibility of the unit standardization instructor pilot and instructor pilots to monitor the type of instruction being presented to unit aviators and ensure maximum correlation with the assigned mission.

Those units that do not have established lesson plans and programed text can request this literature through the Extension Training Development Branch of the Directorate of Training Developments, U.S. Army Aviation Center, Ft. Rucker, AL 36362. Standardization instructor pilots also should ensure that all −10 examinations include several weight and balance and performance chart questions.

AR 95-16 states it is the duty of the unit weight and balance technician to maintain up-to-date weight and balance records, comply with weight and balance provisions of applicable modification work orders (MWOs) and to assist aviators in the use of weight and balance data. It is the responsibility of the aviators to ensure that the weight and balance conditions of their aircraft are within safe limits according to TM 55-405-9. The operators of utility, observation and attack helicopters currently are not required to file a DD Form 365F for each flight; however, they should check the available weight and balance data as a part of their flight planning.

In order to make copies of the DD Form 365Fs that are located in the aircraft's weight and balance file readily available to the aviator, it is recommended that these copies be placed in the flight planning room or in individual aircraft logbooks. This will ensure that aviators not only know the aircraft's takeoff and landing weight, but also know what their aircraft center of gravity limitations are.

NOTICE

Reference: Atmospheric Nuclear Test 1946 To 1963

Headquarters, Defense Nuclear Agency announced the establishment of a toll free telephone number for use by military or civilian employees of the military who participated in the atmospheric nuclear test from 1946 to 1963. Participants in Continental United States should call 800-638-8300. Participants residing in Alaska should call COLLECT to 202-295-0586, and Hawaii residents should call COLLECT to 808-422-9213.

Participants residing outside of the United States should write to: AFRRI, Defense Nuclear Agency, National Naval Medical Center, Bethesda, MD 20014, USA. The following information is requested: Name, social security number, service number, address, telephone number, dates involved with test, military service and unit at test. The Public Affairs point of contact for this effort is the Public Affairs Officer, Defense Nuclear Agency, Washington, DC 20305, telephone 202-325-7095 or AUTOVON 221-7095 (Major Stewart, AUTOVON 227-5081).

A Story of Survival

Thomas E. Martin
La Cayce, SC

MY LAST RADIO call was a fraction of a section before a large grey tree appeared just in front; then there was a collision. The main rotor system and aircraft parted company.

The rotor continued across the valley like a frisbee. The aircraft pivoted to the right around a tree and impacted the ground, tail first. It then rolled a number of times down the hill, coming to rest upright in a dry streambed pointing back up the hill it had just rudely descended.

I was stunned—to say the least—but I was conscious. My head was pinned back to my left and the collective was in the full raised position. I don't remember seeing the cylic at all.

I could hear the engine out audio in my helmet and could feel the heat on my left arm and buttocks. I reach with my right hand and turned the battery switch off. I don't know why, I guess I was in a state of shock but I remembered from flight school that once on the ground after an emergency, you should turn the main fuel and battery switches off.

I became concerned with getting myself out of the burning aircraft. The fire was growing and I was becoming more uncomfortable. I could not unfasten my helmet. The snap on the chinstrap had become a little rusty and was hard to unsnap. I had known about it for some time and "one of these days I was going to get it fixed."

I couldn't get my helmet off and was beginning to panic; I suddenly realized I was going to burn to death. I took the chinstrap in my right hand and jerked. Something broke and my head was free.

I tried to get up but couldn't. I thought, "My back is broken," but then I remembered my seatbelt. It was fastened across my chest from the submarining of my body in the crash. I unfastened it, took one step forward and was clear of the aircraft. The time elapsed since I knew I was going to crash was perhaps 10 to 12 seconds.

With myself free, my next thoughts were for my crewchief. Like all OH-6 Cayuse crewchiefs, he had been sitting on the floor with his seatbelt on very loose so that he could lean out the door to fire his M-60. He had been doing this just before we hit the tree. I don't know how he managed to survive the crash but he was alive and conscious when I reached him.

He was lying on the ground on the right side of the aircraft with his legs pinned under the aircraft from mid-thigh down. He was begging for help. I grabbed his arms and tried to pull him away from the aircraft, but he was firmly pinned. I could not move him or the aircraft. I began to panic again and searched frantically for something to pry the aircraft off him. The only thing I could find was rotten bamboo, which just splintered when force was applied. As I searched for something else, his cries for help stopped. I looked back and his body was engulfed in flames—his agony was over.

With my crewchief dead my next concern was my own survival. I moved into the edge of the vegetation near the aircraft to analyze my situation.

First, I checked my injuries. My left arm was black and yellow, and badly swollen from the burns. I remember thinking it would have to be amputated but because I was in shock the thought did not seem repulsive. My face was burned and when I put my hand on it I felt the skin move. I decided not to look at it. My left leg was the only thing that really hurt, but the pain was not unbearable.

Next, I inventoried my equipment. My Air Force survival vest had been burned and the majority of the equipment was gone. All that remained was the first aid kit, strobe light, mirror and compass. My survival radio, my most important piece of equipment, was gone, but all was not lost. I knew I could signal with the mirror in the daytime and the strobe at night.

The compass would help if I was forced to walk out, or so I thought. I checked the first aid kit to see what was left. The few things that were not damaged were of no use to me, but I kept the kit with me. *In a survival situation, don't throw anything away.*

By now I'm sure it's obvious that this crash occurred in combat in Vietnam. But it is my belief that many of the lessons learned could be applied to almost any combat situation in which Army aviation may become involved.

My next problem was which way to go. Up the hill were the bad guys—down the hill was the river and open ground. Along the side of the hill was vegetation. I knew I had to get to the river sooner or later.

If I went directly to the river I would be seen and probably be caught or killed. I elected to move toward the river, staying in the thick

vegetation as long as I could.

I began to hear enemy voices. They were moving down toward the aircraft. I had to move now! I picked the thickest stuff I could find—bamboo. I got low to the ground and crawled in. I moved to the center of the thicket so I couldn't be seen and tried to put as much ground as possible between the enemy and me.

Soon, I heard the enemy looking for me. I also heard someone else looking for me—helicopters. Hidden inside the thicket I was in the worse position I could be in to be seen by my people. I watched as the helicopters flew right over me at about 50 to 75 feet. I was not seen. I then knew that if I was to get out alive I would have to walk.

Only a short time after my rescuers left, the jets came. They would get revenge for the loss of a brother. The bombs felt hot and heavy. *If only I could let them know I was down here!* I found a small opening in the trees and tried to use my signal mirror. The jets would start their runs from very high, drop their ordnance and climb out steeply. I continually tried to signal them, but I couldn't get their attention. Then I saw an OV-10 spotter plane, very high. I tried to signal the pilot, but the aircraft was so high I couldn't be sure I was hitting it with the flash of light.

As the jets let up, I tried to move farther away from the target. I stayed busy trying to signal, dodge friendly shrapnel, move away from the target and stay out of sight of the enemy. I finally managed to reach a bomb crater on the edge of the thicket and the open field between me and the river.

The jets completed their mission and left. Now I faced another problem—how to cross the field without getting caught. I decided I couldn't make it in the daytime, so I settled back to wait for darkness. I was afraid to relax too much. I felt if I went to sleep, I would not wake up.

Before long, I heard another aircraft engine. It wasn't a jet though. I began looking and soon I saw an old A-1E Skyraider. The pilot was all alone and making cannon runs at the hill above my aircraft from an altitude of about 300 feet. I felt I would soon have company. I began to signal the aircraft with the signal mirror. It seemed I had its attention. The aircraft made a turn and started straight for me. The pilot had seen the flash, but what was that person thinking it was—a mirror or an automatic rifle?

Everything now was on the line for me. I stepped out into the open so the pilot could see me. The aircraft passed over and wagged its wings to let me know I had been seen. But the pilot didn't see me standing in open area; my flashing had been spotted before and I had needlessly compromised my position to the enemy. Still, it was a chance I thought I had to take.

Knowing I would soon be rescued, I lay back in the bomb crater and did the most dangerous thing possible. I relaxed and went to sleep.

I awoke with a start. A Jolly Green Giant CH-53 rescue helicopter was just going behind an adjacent hill, away from me. I had slept through my rescue attempt. The pilot would leave and I would die where I was and no one would ever know how close I had come to being rescued. The Jolly Green made a big hovering turn and came back to where I was. As it hovered overhead, crewmembers lowered a rescue hoist with a jungle penetrater on it. As soon as it touched the ground, I opened two of the arms and got on.

As I rode the hoist back up, I could see my still smoldering OH-6A Cayuse. I had managed to crawl about 400 meters.

As we flew to safety, the medic aboard checked my wounds and gave me something to drink. He attempted to start an I.V., but couldn't find a vein in my right arm. I asked the crew to notify my commander that I had been picked up. I was told this already had been done.

After we landed I was admitted to an evacuation hospital at about 1700 hours. Allowing about a 45-minute flight before I was shot down and an hour flight back to the hospital, I had been down about 4½ hours.

My wounds consisted of third degree burns to 20 percent of my body and second and first degree burns to an additional 7 percent for a total surface burn area of 27 percent.

Why did I survive? I think that can be contributed to several things.

First and foremost was a will to survive. Second, I used what I had been taught about survival at the U.S. Army Aviation Center at Fort Rucker, AL, and in other military schools I had attended in my 5 years prior to flight school.

Third, and last but not least, things fell in the right place at the right time. I could have been killed in the crash, in the fire, by the enemy, by the bombs, or just from exposure.

You may call it whatever you wish, but I believe it was Divine Providence.

In the same situation, would you have survived? I hope you never have to answer that question, but if the situation arises and you are in it, I hope this article helps save your life.

First 17
IERW Gra

Captain Thom[illegible]. B
Department o[illegible]nt T
Ft. Rucker, AL

TH-55 during primary phase

OH-58 performs NOE flight

Students performing N[illegible] flig

IN MARCH 1978 the first students were graduated from the United States Army Aviation Center's Dual Track 175/40 Initial Entry Rotary Wing Aviator Course. At 2-week intervals the Aviation Center will graduate new aviators eager to apply the talents and techniques they have learned during 9 months of extensive academic and flight training.

At present each new graduating class contains a mixture of 75 percent aviators schooled in UH-1 Huey academic and tactical flight subjects, and 25 percent aviators schooled in aeroscout subjects. Never before has the Aviation Center produced an aviator capable of performing as an aeroscout.

The 175/40 Course is a compact training system. (See "Dual Track 175/40 IERW Course," November 1977 ***Digest.***) Graduates receive increased training in tactical flight and academic subjects, and increased training in night operations. Graduates are better able to accomplish missions in adverse weather during peacetime or combat. The 175/40 Course emphasizes principles and techniques of operating aircraft down in the trees—to include navigating during nap-of-the-earth flight. It also places greater emphasis on the latest tactics and aviation doctrine directed

175/40 Graduates

...mas E. Brown Jr.
...ent of ...ght Training
...t. Rucker, AL

Runway lights during night training

...ning N... flight in UH-1 Huey

UH-1 flight simulator

against the threat.

As mentioned earlier, 25 percent of each 175/40 graduating class are taught aeroscout doctrine and tactics. Subjects learned include air cavalry operations, attack helicopter operations and aerial adjustment of artillery fire.

The goals of the Dual Track Course are basically twofold:

- To produce aviators having basic mechanical skills and academic knowledge needed to survive against the threat.
- To graduate aviators who are better prepared to enter a unit's training program.

The new 175/40 graduates possess a better basic knowledge of aviation subjects and skills, and they will require less time to be trained for their unit's mission.

After many months of planning and implementation the Dual Track 175/40 Initial Entry Rotary Wing Aviator Course is finally a reality. Through regular feedback from field commanders, the Aviation Center constantly will improve and refine its flight program. Such cooperation and communication between the Aviation Center and the field ensures the Army has the best possible aviators to fly "Above the Best."

EPMS CORNER

Enlisted Personnel Management System

Air Traffic Controllers and Flight Operations Coordinators

Major Melvin L. Davis
Directorate of Training Developments
Ft. Rucker, AL

THE INTRODUCTION of the Soldier's Manual and the skill qualification test (SQT) to the field has prompted a myriad of questions to be asked by concerned Soldiers as they become increasingly involved and acquainted with these new training and evaluation instruments. With this in mind, this article is offered to help clear up questions about Soldier's Manuals and SQT developed for military occupational specialties (MOS) 71P, 93H and 93J. Some of the most pertinent and frequently asked questions are among those discussed below.

When will I receive my Soldier's Manual?

The first editions of Soldier's Manuals for Air Traffic Controllers and Flight Operations Coordinators have been distributed to active Army field units using a "push" distribution system which is based on assigned strength in each MOS and skill level. Distribution schedules for the manuals are shown in the figures 1 and 2.

The U.S. Army Reserve components receive their manuals by means of the "push" distribution system, with one exception—USAR training divisions and National Guard units are on a "pull" system, i.e., they request the number of manuals needed through appropriate publications requisition channels.

The U.S. Army Training and Doctrine Command (TRADOC) keeps field commanders and test control officers (TCO) informed on Soldier's Manual distribution status by way of electrically transmitted messages. By checking a status message against personnel reports, commanders/TCOs can identify units needing manuals and determine if the manuals have arrived in sufficient copies for distribution to Soldiers having the primary MOS for which the specific manual applies.

Figure 1:
Within the Continental Limits of the United States

MOS	Skill Level 1 and 2	Skill Level 3	Skill Level 4	Skill Level 5
71P	1 Mar 77	1 Nov 76	1 Nov 76	1 Nov 76
93H	1 Dec 77	1 Dec 77	1 Dec 77	
93J	15 Dec 77	1 Dec 77	1 Dec 77	1 Dec 77

Soldier's Manuals should be distributed as follows:

- SL 1 Manual: SL1 Soldier thru highest SL Soldier in MOS
- SL 2 Manual: SL1 Soldier thru highest SL Soldier in MOS
- SL 3 Manual: SL2 Soldier thru highest SL Soldier in MOS
- SL 4 Manual: SL3 Soldier thru highest SL Soldier in MOS
- SL 5 Manual: SL4 and SL5 Soldiers

In the event you have not received your initial issue of manuals, make your needs known through the chain of command. If you should lose a manual, you may order a new one directly from:

Commander
U.S. Army Aviation Center
ATTN: ATZQ-T-E
Fort Rucker, AL 36362

There is a Soldier's Manual reorder form in the back of each manual for this purpose.

When will I take my SQT?

Active duty Soldiers in grade E6 or below with an air traffic controller or flight operations coordinator primary MOS are to be tested for the first time during the period July through December 1978. Those in grade E7 are to be tested during the period July through December 1980. The development of SQT for E8/E9 testing has been deferred pending

further study of the need to test these grades.

The testing of Reserve component Soldiers is scheduled to begin in 1979 with E6s and below being tested first during the period July through December. Testing of E7s is expected to begin in July 1981. The decision to test E8s and E9s is pending.

When will I receive my SQT Notice?

Your commander/supervisor should give you your SQT Notice at least 60 days prior to your scheduled test date. The SQT Notice is an important part of the SQT program and is used to tell you specifically which tasks in the Soldier's Manual will be tested. As you review the SQT Notice, you will be able to determine what additional study or training is needed to prepare you for your SQT. Your SQT Notice should be studied in conjunction with your Soldier's Manual and those references listed in your manual.

What is a Job Book?

The Job Book is a small, pocket-size training circular designed to assist supervisors to keep track of skill level 1 and 2 Soldiers' ability to perform the tasks described in their Soldier's Manual. The Job Book is not an official record nor is it to be retained by the unit or forwarded to the Soldier's new unit. When a Soldier is reassigned, has a change of supervisor or progresses to skill level 3, the Job Book is turned over to the Soldier who may retain it or pass it on to a new supervisor for information purposes. Supervisors should be issued a Job Book for each skill level 1 and 2 Soldier under their supervision. Distribution of Job Books for MOS 71P, 93H and 93J is scheduled to be completed this month.

Who develops my Soldier's Manual and SQT?

The U.S. Army Aviation Center, Ft. Rucker, AL is the proponent agency for all MOS related training and evaluation programs for air traffic controllers and flight operations coordinators. This includes the development of institutional and extension training programs of instruction, Soldier's Manuals, Job Books, SQT and Commander's Manuals for the three MOSs.

Any questions or comments concerning subject matter may be addressed to:

Extension Training Development Branch
U.S. Army Aviation Center
P.O. Box J
Fort Rucker, AL 36362

Is there a Primary Technical Course (or Basic Technical Course) for my MOS?

Both of these courses are available through the Army Correspondence Course Program. The Primary Technical Course is a self-teaching exportable package (STEP) that is designed to prepare skill level 1 Soldiers for skill level 2 duties. Thus, it also helps prepare you for your SQT. The Basic Technical Course also is a STEP. It is designed, however, to prepare skill level 2 Soldiers for skill level 3 duties.

How do I go about enrolling in the Primary (or Basic) Technical Course?

You may enroll by completing DA Form 145 (Army Correspondence Course Enrollment Application) and mailing to:

Army Correspondence Course Program (ACCP)
U.S. Army Training Support Center
Newport News, VA 23628

Before you do, however, you may want to check with your supervisor/commander to see what the unit has planned to meet your training needs. Guidance for commanders/supervisors is provided in a Commander's Manual published for your specific MOS.

Of importance to commanders are the addresses listed in the Commander's Manual for obtaining instructional material for your MOS. In addition to the addresses, the Aviation Center recently has established a 24-hour answering service to provide information and assistance to the 2,200 plus Active Army and Reserve component activities it serves. The telephone numbers of the answering service are: AUTOVON 558-3098 or Commercial (205) 255-3098. The Commander's Manual is designed to assist commanders in fulfilling their responsibilities to Soldiers in their command and to help them understand the Enlisted Personnel Management System (EPMS). By understanding EPMS, commanders are better prepared to see to it that their Soldiers get appropriate schooling and training for career development. The distribution of Commander's Manuals for MOS 71P, 93H and 93J was completed last April.

What is the Soldier's Manual of Common Tasks?

The Soldier's Manual of Common Tasks has been published for Soldiers who will not have an MOS-specific Soldier's Manual such as yours. This manual is not intended to be used for SQT purposes, but rather as a reference and training guide for those in an MOS for which a Soldier's Manual will not be published. It also serves as a reference and guide for training developers who write MOS-specific Soldier's Manuals.

Figure 2:
Outside the Continental Limits of the United States

MOS	Skill Level 1 and 2	Skill Level 3	Skill Level 4	Skill Level 5
71P	1 Apr 77	1 Feb 77	1 Feb 77	1 Feb 77
93H	1 Jan 78	1 Jan 78	1 Jan 78	
93J	15 Jan 78	1 Jan 78	1 Jan 78	1 Jan 78

OPMS CORNER

Officer Personnel Management System

Graduate Flight Training and Aviator Management

Major Jacob B. Couch Jr.
Aviation Management Branch
U.S. Army Military Personnel Center
Alexandria, VA

DURING THE past year, articles have appeared that discussed the many facets of the Officer Personnel Management System (OPMS) aviation specialty. However, the Military Personnel Center (MILPERCEN) continually receives inquiries from the field concerning the graduate level training courses taught by the various aviation-related service schools. These questions usually revolve around the need for obtaining a quota for a particular course. In hopes of answering these questions, the following information addresses graduate level training for Army aviators.

Aviator Training—Quotas for the various graduate level training courses are based on Army requirements to meet "the needs of the Army." These courses are listed in Department of the Army (DA) Pamphlet 351-4, "Formal Schools Catalog." Once established, the Aviation Management Branch manages the allocation of quotas for the entire Army. This centralized management ensures maximum use of quotas, since each quota is directly equivalent to allocated training dollars.

Individuals are selected to attend graduate level courses either on temporary duty (TDY) enroute to a permanent change of station (PCS) or in a TDY status. Regardless of the situation, individuals must need the training to meet the requirements of their projected or current assignment. The days of blanket multiple aircraft qualification have gone. Individuals are now trained in a type aircraft and utilization is planned in that aircraft.

A request for training during a PCS move will be coordinated by the individual's assignment officer prior to issuing orders. In this case, the cost of TDY and travel pay will be funded by Department of the Army.

A request from the field must be processed in a slightly different manner. The individual initiates paperwork through channels to MILPERCEN, ATTN: DAPC-OPP-V (Aviation Management Branch) to attend a selected course. The request must be indorsed by each level of the command. During this process, two items of information are essential.

- Complete justification as to the need for training must be included. This information will be used in determining the priority for attendance.
- A statement must be included that the requesting command will fund the travel and TDY cost associated with the course.

Once the request reaches the Aviation Management Branch, the individual's name is placed on a "standby" list for the course. As vacancies become available, applications are evaluated based on the justification as contained in the application. Selectees are notified through channels and orders are issued by their organizations.

While changing requirements have forced reductions or eliminations of certain courses, the training base is still sufficient to provide all the graduate level training that is needed within the Army.

Aviator Management—It is important to understand how aviators are managed to meet the requirements of the Aviation Career Incentive Act of 1974, better known as "the gates." First, it should be noted that the Army must report to Congress, each year, on how it has managed aviators toward meeting their 12th and 18th year gates.

In this light, MILPERCEN attempts to fill aviation positions with individuals who need the operational credit to help achieve gate passage. In many cases a remark addressing this subject is placed on aviators' orders when they are issued by DA. However, once the individual arrives within the gaining command, current command requirements must be evaluated.

The commander and the individual aviator must make a *conscious decision* if the individual is not going to be assigned to an operational flying position. This is because of the far-reaching impact it can have on the individual's future utilization within the aviation program and the Army's ability to justify future aviation training. Every effort should be made to allow individuals in this category the opportunity to spend a portion of their tour in an aviation assignment.

Helicopter Control System

Members of the Integrated Helicopter Control System team are: Kneeling (L-R), John D. Waugh, project engineer; and Major David Yensan, pilot in charge. Standing (L-R), John Allison, crewchief; Robert Brucksch, instrumentation technician; and John A. Stephens, the system's coinventor and team leader for its development (Photo by Ruth Hawks)

AN EXPERIMENTAL helicopter control system which has been under research and development the last five years at Aberdeen Proving Ground (APG) MD, made its official debut 30 January with a 17-day swing through five Army installations.

Developed by a research team of the U.S. Army Human Engineering Laboratory (HEL) at APG, the "Integrated Helicopter Control System" permits a pilot to fly the aircraft one-handed. In all conventional helicopters, the pilot must use both hands.

The ramifications of the new system are essentially four-fold, according to John A. Stephens, an HEL engineer who is the system's coinventor and team leader for its development.

Stephens said the system is (1) expected to increase substantially the survivability factor for the crew in the event the pilot is wounded or injured; (2) simplify the overall task of helicopter flying; (3) ultimately reduce pilot training requirements; and (4) allow a new approach to cockpit design and simplification.

In essence, the experimental system combines the collective and cyclic controls of the helicopter into one integrated unit.

John D. Waugh, project engineer for the Integrated Helicopter Control System, makes a final preflight check during second-phase developmental testing of the new system at Aberdeen Proving Ground (Photo by Ruth Hawks)

Under the conventional system the collective performs two basic functions: it varies the lift needed for helicopter flight and modifies the power from the engine to maintain a certain revolutions per minute reading. The pilot uses the left hand to operate the collective function. The cyclic, which oversees the aircraft's attitude and direction, is operated with the right hand.

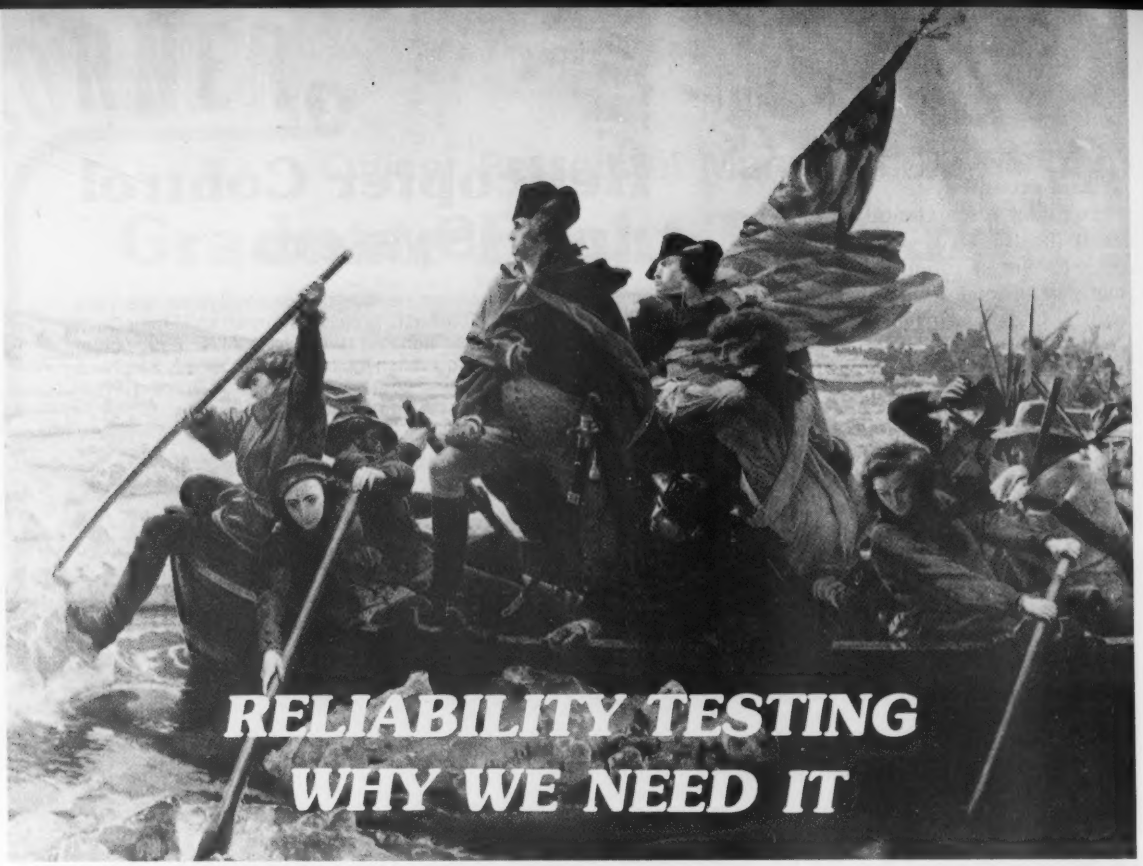
The integrated unit is similarly floor mounted. However, all functions of the collective and cyclic are combined into two pistol-grip type handles located at the top of the control shaft, about chest level with the seated pilot. Using either hand, the pilot can perform all tasks previously required of both hands.

The research team installed the first developmental prototype in a OH-58 Kiowa helicopter in late 1975. That system was successfully flight tested in January and February of 1976 at APG's Phillips Army Airfield.

After the initial flight testing, the team developed a second prototype, which was successfully flight tested at APG late last year.

On 30 January the recently refurbished OH-58 with the second developmental prototype embarked on its 17-day trip with stops at Ft. Eustis, VA; Ft. Bragg, NC; Ft. Rucker, AL; and Ft. Knox and Ft. Campbell, KY.

Major Dave Yensan of the HEL research team piloted the aircraft, using the conventional control system which was left intact in the copilot's area as a safety back-up system. MAJ Yensan was accompanied by John D. Waugh, the project engineer; crewchief John Allison; and instrumentation technician Robert C. Brucksch.



RELIABILITY TESTING WHY WE NEED IT

Robert L. Miller
U.S. Army Aviation Board
Ft. Rucker, AL

WHEN GEORGE WASHINGTON, Commander of the Continental Army, decided to cross the icy waters of the Delaware River on Christmas night in 1776 and attack the Hessians by surprise, his requirements for a form of transportation probably went something like this: "I need 100 rowboats capable of carrying 24 battle-equipped Soldiers each. The boats should be able to transport the Soldiers safely across an icy river, deliver the troops and then return with the troops, after the battle, across the same river."

Although George didn't know it at the time, he was spelling out reliability requirements. Reliability is defined as "the probability of an item to perform its intended function for a specific interval under stated conditions." If the item does not perform its intended function under the stated conditions, then a failure is charged to the item's reliability. This article deals with reliability, why it is necessary and how the U.S. Army tests for it.

When George stated his requirements (reliability criteria) for transportation some 200 years ago, he was not able to benefit from pretesting the equipment before it was fielded. A new piece of equipment usually was fielded using the trial and error system. For example, if George's boat struck a piece of floating ice causing the boat to sink, the next time he needed rowboats for the same type of mission he would require a boat with a hull that would withstand ice strikes.

Today, in a world full of complex electronic/mechanical equipment, the U.S. Army can't afford to field a system using a trial and error method. Millions of dollars of equipment would be scrapped if the equipment was mass-produced, fielded and then failed to perform its intended mission due to a defect that could have been detected during reliability testing. The Army cannot afford this kind of waste nor can a field commander afford to have unreliable equipment that fails to perform its intended mission.

Reliability testing of new equipment is performed by the U.S. Army to provide necessary information to the decisionmakers who must determine if further development is needed to meet the reliability requirements. Although it is critical that new equipment perform as designed, it is equally important that nothing happens to that equipment to prevent if from performing for an extended period without failure.

When equipment is produced by private industry, it is designed to meet predetermined requirements or criteria established by the Army. Reliability criteria usually are expressed in terms of percent probability of completing a mission of known duration and/or in mean time between failure (MTBF). To establish these criteria, the combat and materiel developer communities put their heads together to come up with a picture of the anticipated usage

of the equipment to be developed.

First, mission profiles (MP) are established to describe each type of mission the equipment will be required to perform. For example, a new helicopter could be designed to perform gunship, troop transport or cargo-carrying missions. These mission profiles are combined into an operational mode summary (OMS) to reflect what percent each mission profile will be used for the total operational life of the equipment and the environment in which each mission profile will be performed, such as the total operating hours in either nap-of-the-earth or instrument flight. From the mission profile/operational mode summary technique plus past experience and military knowledge, the combat/materiel developer will develop the baseline reliability criteria in terms of percent probability of mission success or mean time between failure.

The final established reliability criteria must be both practical and affordable while permitting the equipment to perform its intended mission. For example, a helicopter-mounted hoist used for personnel insertion and extraction must be extremely reliable because human life is at stake. However, a piece of aviation ground equipment will be acceptable with lower reliability since other equipment normally is available should it fail. General Washington's requirements would have been satisfied reasonably with a wooden hull rowboat of sufficient thickness to withstand ice strikes. A steel hull would have been unnecessarily strong, as well as excessively expensive, and therefore be over-designed to meet his reliability requirements. Thus, equipment reliability should be only as practical as its mission requires.

The cost of developing a piece of equipment increases directly with an increase in its reliability requirements. If the U.S. Army sets reliability requirements too high the initial acquisition cost to design and produce new equipment would be driven so high that the equipment would not be affordable. This concern with initial acquisition cost is further emphasized by the total life cycle cost when the equipment is fielded. Figure 1 represents how the proportions of the support and acquisition cost that make up the total cost are impacted with changes in reliability design.

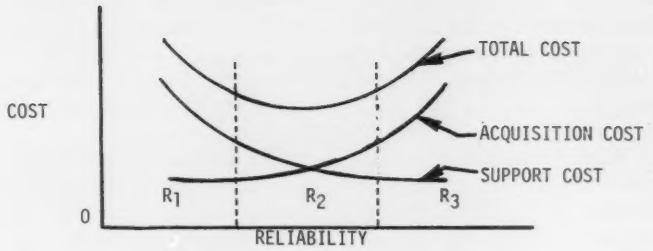


FIGURE 1. TOTAL LIFE CYCLE COST

For example, if the procurement decision is to initially lower new equipment reliability requirements (R_1) in order to reduce initial acquisition cost, then the support cost for the life of that equipment will rise due to increased support burden. Therefore, the total cost of that equipment would exceed the total cost required by the same equipment if it had higher initial reliability requirements (R_2). On the other extreme it is found that if initial reliability requirements are too high (R_3) then the total cost, even though support costs are minimal, will again be excessive due to the high initial acquisition cost. Thus, a range for reliability requirements between the dashed lines (figure 1) must be held in order to keep acquisition/support cost, and therefore total cost, affordable.

Reliability requirements are provided to private industry for equipment development after all criteria are optimized. Usually, a few units of the equipment are produced for Army testing before a decision is made to continue development of the equipment; enter into another production phase; or cancel further production based on the equipment's ability to meet design requirements, including reliability requirements.

Reliability testing to determine if the equipment meets the predetermined reliability goals consists mainly of "hardware reliability" and "mission reliability."

"Hardware reliability" testing considers the equipment performance alone, without consideration for its interface with Army personnel in the field, and is often tested in a controlled laboratory environment.

"Mission reliability" testing attempts to perform the total operational mission that the equipment is designed to accomplish when placed in the field environment and interfaced with Army personnel.

The reliability testing conducted by the Army is the responsibility of different test activities, depending on the nature of the test. Most of these tests fall under the responsibility of the developmental and operational tester. The developmental tester is concerned with hardware-oriented reliability testing, while the operational tester is responsible for mission reliability testing.

The U.S. Army Aviation Board, located at Cairns Field, Fort Rucker, AL, is responsible for operational testing on most of the nonmajor equipment developed for possible use by U.S. Army aviation. Before the Aviation Board conducts operational testing to evaluate the mis-

sion reliability of an item of equipment, it must also be provided with a failure definition by the same combat developer that furnished the mission profiles/operational mode summary.

This failure definition will provide a baseline against which malfunctions are scored during a test to determine if the malfunctions will impact on the equipment's mission reliability. The failure definition often will state that if a malfunction can be repaired within a given time frame, then no failure will be charged against the equipment. Malfunctions of equipment due to operator error, or incorrect maintenance procedures (unless due to incorrect maintenance manual information), or equipment operation beyond its design limits are likewise not chargeable failures.

Application of the failure definition to each test malfunction will determine chargeability of the failure for mission reliability analysis purposes. Final determination of a failure is provided by a scoring conference consisting of representatives from the combat developer, materiel developer, operational evaluator and developmental evaluator. This scoring conference is held at the end of testing.

The failure definition could apply to both hardware and mission failures, the difference being—did the failure result in a mission abort? For example, one of the oars in General Washington's lead rowboat could have failed, yet enough oars were left to allow this rowboat to reach its destination safely. A hardware failure occurred, but the mission was not aborted; thus, no mission failure was charged.

A recent reliability requirement is the measurement of "operational reliability" which considers the same total operational environment that mission reliability considers, except that operational reliability also considers such test incidents as operator errors, maintenance errors or incorrect manual procedures. The only incidents which would be excluded are those caused by operating the equipment beyond specified limits, sickness of operators from sources outside the operational environment, combat damage or equipment modifications.

The operational reliability is the most realistic assessment of all the factors which equipment will encounter in the operational environment, and reflects a realistic estimate of that equipment's probability of completing its intended function. Although accurate operational reliability can only be determined after the equipment has been fielded for a lengthy period, a properly simulated user environment as designed by the operational tester will give the decisionmaker a very good approximation of the equipment's operational reliability.

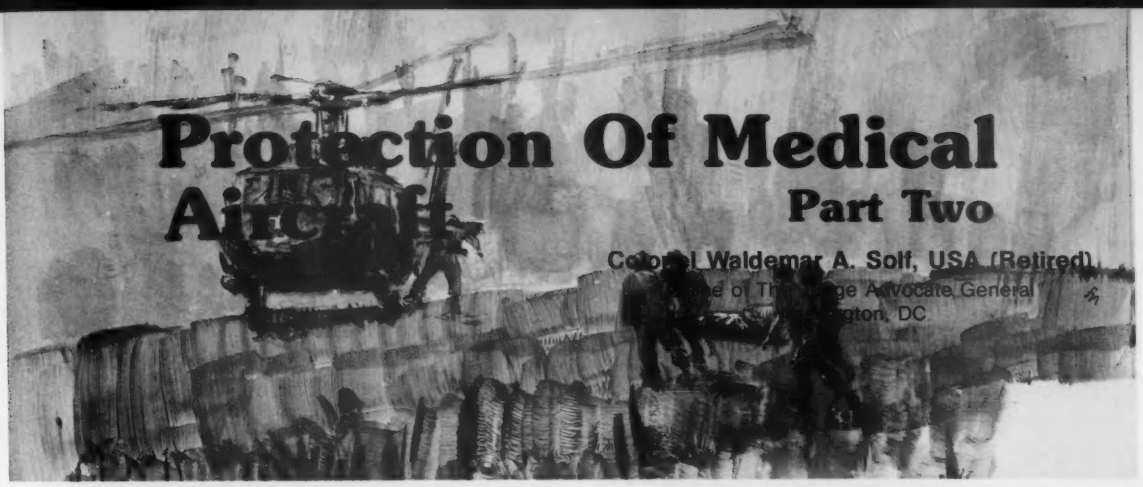
Designing an operational test to provide maximum results for reliability assessment will require maximum simulation of the operational environment the aviation equipment is intended to operate in. Green-suited Army equipment operators (often aviators) and maintenance personnel are required along with the tools, test equipment, technical manuals, spare parts and training necessary to operate and maintain the equipment. The equipment must be subjected to the climatic environment and perform the mission intended and outlined in the mission profile.

If the above can be achieved satisfactorily, the main element remaining for obtaining maximum reliability test results is an extensive test period for sustained equipment operation and accurate data collection of test incidents as they occur.

Reliability analysis is primarily based on two parameters taken from the collected data: (1) The total operating time of all equipment being tested, and (2) the total number of chargeable failures which occur during the test period based on all equipment data coming from identical operating environments. The reliability analysis will consist of both mathematical and statistical applications to the test results. The validity of the results will increase with an increase in test operation time. The reliability analysis could be in terms of equipment mean (average) time between failures or as a percent probability of completing the intended function. The results of the test will provide the decisionmaker with a prediction of what the actual reliability of the tested equipment will be over the equipment's life assuming no modifications are made. The operational tester reliability analysis will be assessed in terms of mission or operational reliability, or both, based on the failure definition provided prior to testing. The results will be compared against the reliability requirements (criteria) provided prior to the test to give the decisionmaker the knowledge that the test criteria was or was not met.

Operational testing provides the decisionmaker with significant data on the reliability characteristics of new equipment when inserted into its intended environment. This information, along with the results of other issues addressed by operational testing, is necessary for the decisionmaker to assess effectively new or improved equipment. Reliability testing is also a good indicator of how well industry is producing equipment that can be depended upon to perform its function at a reasonable cost.

If George Washington's transportation requirements had resulted in the selection of new boats which sank in midstream because of hull failures, then the battle at Trenton would not have occurred and the history of our Nation might have had a different ending. George's river crossing would not have been left to chance if his transportation decision could have been backed up by the results of adequate reliability testing. The U.S. Army cannot leave equipment reliability to chance—reliability testing is the answer.



Protection Of Medical Aircraft

Part Two

Colonel Waldemar A. Solf, USA (Retired)
Member of The Judge Advocate General's
Washington, DC

RELEVANT TEXTS OF PROTOCOL I
PART II—WOUNDED, SICK AND SHIPWRECKED
SECTION I—GENERAL PROTECTION

Article 8—Terminology

For the purposes of this Protocol:

* * * * *

(f) "Medical transportation" means the conveyance by land, water or air of the wounded, sick, shipwrecked, medical personnel, religious personnel, medical equipment or medical supplies protected by the Conventions and by this Protocol;

(g) "Medical transports" means any means of transportation, whether military or civilian, permanent or temporary, assigned exclusively to medical transportation and under the control of a competent authority of a Party to the conflict;

* * * * *

(j) "Medical aircraft" means any medical transports by air;

(k) "Permanent medical personnel," "permanent medical units" and "permanent medical transports" means those assigned exclusively to medical purposes for an indeterminate period. "Temporary medical personnel," "temporary medical units" and "temporary medical transports" mean those devoted exclusively to medical purposes for limited periods during the whole of such periods. Unless otherwise specified the terms "medical personnel," "medical units" and "medical transports" cover both permanent and temporary categories.

COMMENT: Under these definitions an aircraft is a medical aircraft only if it is under the control of a party to the conflict and assigned exclusively to the conveyance of the wounded, sick, shipwrecked, medical personnel, religious personnel, medical equipment or medical supplies. The assignment may be permanent or temporary, but in either case, the aircraft must be exclusively devoted to medical purposes.

(l) "Distinctive emblem" means the distinctive emblem of the red cross, red crescent or red lion and sun on a white ground when used for the protection of medical units and transports, or medical and religious personnel, equipment or supplies;

(m) "Distinctive signal" means any signal or message specified for identification exclusively of medical units or transports in Chapter III of Annex I to this Protocol.

* * * * *

Article 18—Identification

1. Each Party to the conflict shall endeavour to ensure that medical and religious personnel and medical units and transports are identifiable.

2. Each Party to the conflict shall also endeavour to adopt and to implement methods and procedures which will make it possible to recognize medical units and transports which use the distinctive emblem and distinctive signals.

* * * * *

4. With the consent of the competent authority, medical units and transports shall be marked by the distinctive emblem. The ships and craft referred to Article 22 of this Protocol shall be marked in accordance with the provisions of the Second Convention.

5. In addition to the distinctive emblem, a Party to the conflict may, as provided in Chapter II of Annex I to this Protocol, authorize the use of distinctive signals to identify medical units and transports. Exceptionally, in the special cases covered in that chapter, medical transports may use distinctive signals without displaying the distinctive emblem.

6. The application of the provisions of paragraphs 1 to 5 of this Article is governed by Chapters I to III of Annex I to this Protocol. Signals designated in Chapter III of the Annex for the exclusive use of medical units and transports shall not, except as provided therein, be used for any purpose other than to identify the medical units and transports specified in that Chapter.

* * * * *

8. The provisions of the Conventions and of this

Protocol relating to supervision of the use of the distinctive emblem and to the prevention and repression of any misuse thereof shall be applicable to distinctive signals.

COMMENT: Article 18 contains the basic provisions for identification of medical personnel, units and transports. Annex I to the protocol provides guidance for detailed implementation.

Paragraph 2 is the basic provision which obligates the Parties to do their best to adopt methods and procedures to recognize medical aircraft which use distinctive signals. This involves the installation and maintenance of equipment for recognition of signals commensurate with capability of the Parties to engage aircraft. The degree of sophistication required for recognition depends on the range and sophistication of the surface-to-air weapon system.

Paragraph 4 preserves the authority of the appropriate commander to determine whether medical transports will be marked with the distinctive emblem.

See Annex I, Article 5 for the implementation of paragraph 5.

PART II—WOUNDED, SICK AND SHIPWRECKED
SECTION II—MEDICAL TRANSPORTATION

Article 24—Protection of medical aircraft

Medical aircraft shall be respected and protected, subject to the provisions of this Part.

COMMENT: This is the basic article on the protection of medical aircraft. It eliminates the requirement for agreed flight plan unless such requirement is preserved for particular situations in some other article of the section (Articles 27, 28, paragraph 4). As supplemented by Article 25, this article provides protection for medical aircraft operating over friendly territory on land for long-range medical evacuation.

Article 25—Medical aircraft in areas not controlled by an adverse Party

In and over land areas physically controlled by friendly forces, or in and over sea areas not physically controlled by an adverse Party, the respect and protection of medical aircraft of a Party to the conflict is not dependent on any agreement with an adverse Party. For greater safety, however, a Party to the conflict operating its medical aircraft in these areas may notify the adverse Party, as provided in Article 29, in particular when such aircraft are making flights bringing them within range of surface-to-air weapons systems of the adverse Party.

COMMENT: Article 25 explicitly frees medical aircraft from the requirement for agreed flight plans in land areas under the physical control of friendly forces and sea areas not controlled by adverse forces, medical evacuation flights in rear areas, the communication zone and intercontinental evacuation are thus generally protected without formality.

Medical evacuation flights in the battle area, however, particularly within range of the enemy's surface-to-air weapons system are less secure. Accordingly, notification of the flight plan is a recommended precaution in addition to the display of the distinctive emblem and the distinctive signals.

Article 25 makes a necessary distinction between land and sea. On land there are usually well defined areas under the physical control of a Party. Most of the sea, however, is free for neutral or humanitarian ships and aircraft, but there may be areas of the sea which the adversary controls, such as the sea around island bases or that adjacent to defended areas of the territorial sea or along straits. Thus a reasonable regime at sea is to permit flights without agreement except over areas controlled by the adverse Party. The term "physical control" is used to avoid terms having legal connotation.

Article 26—Medical aircraft in contact or similar zones

1. In and over those parts of the contact zone which are physically controlled by friendly forces and in and over those areas the physical of which is not clearly established, protection for medical aircraft can be fully effective only by prior agreement between the competent military authorities of the Parties to the conflict, as provided for in Article 29. Although, in the absence of such an agreement, medical aircraft operate at their own risk, they shall

nevertheless be respected after they have been recognized as such.

2. "Contact zone" means any area on land where the forward elements of opposing forces are in contact with each other, especially where they are exposed to direct fire from the ground.

COMMENT: At the 1972 Conference of Government Experts, this article was the most hotly debated provision within the committee dealing with the wounded, sick and shipwrecked. The concept ultimately adopted was a compromise worked out by the United Kingdom, Sweden and the German Democratic Republic. It reflects realistic recognition that medical air evacuation involves high risk of misidentification in the area where the forward elements of opposing forces are in contact with each other, and in areas where control is disputed. Although recognizing that medical aircraft operating in such areas have a legal right to protection within areas under the control of friendly forces, it nevertheless acknowledges the risk and recognizes that effective protection depends on an agreement.

The definition of "contact zone" was facilitated by an article by LTC Frederic de Mulinen in which he aptly described the forward part of the battle area: "...In the 'forward part' are to be found units in direct contact with enemy vision and hence to direct firing. In the 'rear part' of the battle areas are the units belonging to the second echelon and the reserve levels of troops in hostile contact. They are less exposed to enemy vision and firing, and there is, therefore, greater freedom of movement..." (Signaling and identification of Medical Personnel and Materiel, International Review of the Red Cross, September 1972).

A more expressive description was made by a British Brigadier who referred to the contact zone as "a place where one does not go bouncing about in a jeep."

(Editor's note: In Part One of "Protection Of Medical Aircraft," which appeared in the April issue of the *Digest*, reference was made to the statement of the U.S. Representative. Below the statement appears in its entirety as it was presented at the 1974 Session of the Diplomatic Conference.)

Statement of U.S. Representative

"Mr. Chairman: 105 years ago, 160 wounded soldiers of France were successfully evacuated from besieged Paris by medical aircraft-balloon—and the potential of rapid medical evacuation by air became a reality.

"It is an undisputed medical fact that the sooner a badly wounded person gets under the care of a surgeon, the better are the chances of... recovery and... survival. It also is recognized, as an undisputed military fact, that medical aircraft pose a security threat if they are used for military reconnaissance, and thus throughout the history of the development of medical aircraft, their role in the search of the battlefield for wounded has been restricted.

"In 1929, on the initiative of France and Great Britain and based on the experience of World War I, our predecessors developed what they believed to be a reasonable regime which provided for rapid air evacuation and also accommodated the concern of military command for security. Medical aircraft, under the provisions of Article 18 of the 1929 Red Cross Convention, were to be painted white and to display clearly the Red Cross. They were free to fly up to the line of medical clearing or dressing stations. Forward of that line and within areas controlled by the adverse party a special and expressed agreement was required.

"The experience of Article 18 of the 1929 Convention in World War II was not a happy one:

a. Parties wanted to use the aircraft for logistic purposes when not used for medical evacuation. Thus, they were not protected.

b. Even when dedicated medical aircraft were used, the distinctive em-

blem could not be recognized at distances within the range of antiaircraft weapons capable of attacking the aircraft.

"Thus, in 1949 the pattern adopted for the First, Second and Fourth Conventions was to provide protection only while medical aircraft flew under an agreed flight plan even when operating deep in friendly territory. Flights over enemy territory were prohibited in the absence of an agreement. Such agreements have not been easy to achieve. No ready means for communication was provided.

"The 1949 regime had thus nailed medical aircraft to the ground, whether they were temporary or permanent unless the side operating the aircraft had air superiority. This regime is generally believed to be entirely unsatisfactory.

"Technological development made a new regime feasible:

a. By means of light signals, the visual range of recognition of the distinctive emblem can be extended somewhat. A readily available system of radar signals based on SSR which can be adapted to any air traffic control radar and target acquisition radar systems, extends the means of identification to the range of weapons capable of attacking aircraft. Radio offers another means for extending recognition and communication among adversaries where agreement or notification is required.

b. A major technological development was the widespread use of helicopters and other light aircraft capable of operating in the battle area almost as readily as ground ambulances. They were capable of evacuating, within minutes, the seriously wounded of either side to a surgical hospital, whereas hours might be required to accomplish the same result by land transport.

"At the Second Conference of Government Experts in 1972 the U.S. Delegation proposed a new regime after technical experts agreed that extending the recognition of medical aircraft was feasible by means of lights, radar and radio. Our proposal was debated extensively but it did not achieve consensus. Consensus was, however, achieved on a compromise plan advanced by the delegations of Sweden, the German Democratic Republic and the United Kingdom. This plan, modified in detail only, is the present basis of the ICRC text as well as the amendment offered by our cosponsors. Its basic terms are:

a. For overflight of areas controlled by adverse forces, previous agreement is required.

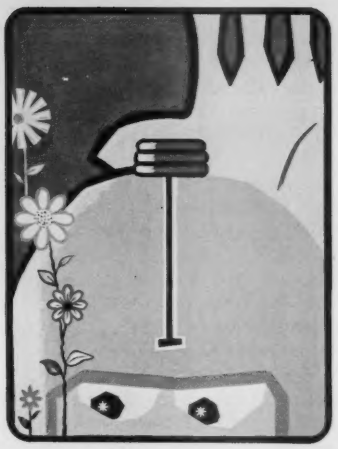
b. For movement in the rear part of the battle area and other areas controlled by friendly forces no agreement is required. It remains within the discretion of the appropriate commander whether to give the adverse Party notice of such flight.

c. For movement in the forward part of the battle area under the control of friendly forces, and in areas where control is not clear, agreement between local military commanders is recognized as the only effective means for providing protection and is thus strongly recommended. Nevertheless, it is also provided that if medical aircraft fly over such areas without an agreement, they shall be respected when they are recognized as medical aircraft.

"Of course it is realized, and the records should show this affirmatively, that 100 percent security is not possible. Honest errors will be made. As a result of honest misidentification, medical aircraft will be lost. On balance, however, we believe that the regime that we now support will make the risk of using medical aircraft in their lifesaving role an acceptable risk..."

Next month the *Digest* will carry Part Three of "Protection Of Medical Aircraft"

VIEWS FROM READERS



Editor:

Reference the inquiry (VFR Column, January issue) about the use of amber and blue plexiglass for use during hooded flight in Army aircraft. Yes, the Army did use this combination of plexiglass as late as 1958 when I came back from Germany.

When the Army got into the instrument flying business it had no experience to go on for "how to do it" and used much of the experience from the, then, CAA pilots and instructors. As a matter of fact much of the early training was done by CAA pilots which is what I was when I attended the Spartan School of Aeronautics in Tulsa, OK.

With the fixed wing aircraft the entire lower portion of the plane was solid fuselage as opposed to the open chin bubble on the helicopter. On the original system the front and side windshields and windows were covered with a piece of amber plexiglass and the student pilot wore a pair of wrap around blue glasses. The combination of the two polaroid substances prevented the student from seeing outside of the aircraft.

As time went on the density of air traffic increased, so that the amber color reduced the ability of the "safety pilot" to see other aircraft. This was especially hazardous in the airport terminal area where instrument approaches were being made. So the CAA/FAA stopped using this method of hooded flight and went to the hood as we know it today. Of course I have my own ideas about that device of torture.

A point of interest, one of our pilots in the Seventh Army Flight Detachment, I believe it was LTC Cliff Johnson (Ret), prefabed a two-inch wide strip of the amber plexiglass onto the glasses by bending the ends at 90 degrees to the wrap around portion and fastening it to the glasses with small bolts that allowed the pilot to position the strip for his height in the seat and produced the same effect as using plexiglass all around the aircraft.

H. Edward Ziegler
1914 Hercules Drive
Colorado Springs, CO 80906

Editor:

Shame on you and a tour on the Eastern Front for you, the editor of *Armor,* and the artist who drew SSG Boudinot in "The Indispensable Scout" by BG D.K. Doyle, ***Aviation Digest,*** December 1977.

While SSG Boudinot looks very dashing with his goggles on his helmet and stirs memories of Erwin Rommel in our minds, I direct your attention to FM 5-20, "Camouflage," May 1968, Chapter 3, page 28, para 16, "Shiny Objects: Reflection from brightly shining objects is a common breach of camouflage discipline. All shiny objects must be concealed. This includes such items as watches, rings, belt buckles, and mess kit items. *A common breach of discipline is the wearing of goggles on the helmet. This is a violation which should be avoided."*

BG Doyle describes scouts as ranging from "the old trooper, tactically experienced NCO to the young PFC or SP4." TRADOC Bulletin 6, "Countersurveillance And Camouflage," 30 Jan 1976, pages 2 and 3 says, "To be seen is to be hit! To be hit is to be killed" and "Camouflage must be a state of mind." If some young PFC or SP4 chooses to emulate SSG Boudinot, he may not live long enough to become an "old trooper." Worse yet he could take you or me or his whole company with him!

The Army spends a considerable amount of money to produce field manuals and training publications; it is a shame to negate their value with a moment of editorial carelessness.

Thank you.

SSG Kenneth K. Leithold
Airfield Service Supervisor
Paine Field
Everett, WA 98204

Editor:

With regard to the comments in the January 1978 issue regarding view limiting devices for instrument training, the following is furnished from personal experience.

The issue of new L-17 aircraft to the National Guard in 1949 included a kit containing sheets of amber plastic and templates for cutting to fit inside the windshield. The blue glass was cut to fit the old dust goggles. Used together the two made an effective training device. It did, however, have sufficient drawbacks which made me discontinue its use:

- The glare from the amber glass tended to restrict the vision of the safety observer.
- The blue glass seemed to produce or enhance vertigo in some pilots.
- The constant remove and replace

procedure for the plastic scratched both the windshield and the amber plastic.

• Aircraft vibration caused abrasion between the windshield and the plastic.

In 1951 we locally purchased the first of the view limiting goggles for "hooded" flight and they were a considerable improvement.

On another matter—I am enclosing my Liaison Pilot orders showing an effective date of 17 Dec 48. You may recognize other members of Class 48 B-L shown therein.

By the grace of God and the Adjutant General of Kansas, I am still on flying status and maintaining currency in the OH-58 and U-3, as State Army Aviation Officer of the Kansas Army National Guard with duty station at Forbes Field, Topeka, KS.

My original "L" wings repose on my office wall in a framed picture of old BUF, our famous CH-37B which was destroyed in place at Springfield, MO by a hovering (backward) Marine CH-53.

Maybe we could start another fad. How about hearing from pilots qualified on the Brodie Gear? I engaged the hook as a student pilot but never had occasion to qualify.

COL Donald J. O'Toole
Kansas Army National Guard
P.O. Box 19061
Topeka, KS 66619

Editor:

I received the following letter which should be shared with *Aviation Digest* readers.

Captain Haker makes some good points concerning problems with "killing a ZSU." The limitations of the current 7.62 mm machine gun are well known and we are replacing them with 20 mm and later on 30 mm guns. Unfortunately, they might not arrive in Europe before Captain Haker's DEROS [date eligible for return from overseas]. AN/APR-39s are slated early on for Europe's helicopter fleet.

I will not challenge Captain Haker on some of his other points. However, I'd ask for further comments from the field to continue the dialogue.

COL John C. Bahnsen
TSM, Attack Helicopter
Ft. Rucker, AL

TRADOC System Manager, AAH:

I am Operations Officer of Air Troop (Attack Helicopter), 11th Armored Cavalry Regiment. I have commanded Infantry companies and also have been an attack platoon leader and maintenance platoon leader here with the 11th ACR. Additionally I served a tour at Aberdeen Proving Ground where I had the opportunity to fly weapons systems which are still under development. I submit this information so that you may have a better evaluation of what I write. My intent is the same as yours, to express my opinion of employment problems of the attack helicopter, against the ZSU-23.

To limit the length I will quote your article and then comment. All my comments are directed toward war today, because that is where this unit is located.

• "Gun Dish radar is a distinct signature." Vehicle identification is very difficult even with the optics of the TOW Cobra. Reforger 76 gave us great problems and these vehicles were not even camouflaged. Vehicles just parked along tree lines were even very difficult to see let alone identify.

• "Gun Dish radar can be made inoperative with... 20 and 30 mm projectiles." This is something sorely needed by attack helicopters right *now*. The present 7.62 is very limited and gives us no immediate suppression of the ZSU-23. The 20 or 30 mm also would give an air-to-air firepower capability.

• "Radar gives distinct paint on the radar warning receivers found in U.S. Army helicopters." We have been told that we may see them some time this year. There is an immediate need for these because of the difficulties of visual contact. I hope these have a higher reliability than most electronic systems of the present attack helicopter.

• "One scout observes while the other acts as decoy." We always work with either scouts or guns in overwatch, but this directly conflicts with the saying of what can be seen, can be hit! We don't purposely expose ourselves.

• [You discussed] Destruction of ZSU with artillery and close air support. It is my hope of course, that the ZSU would be destroyed or at least had sustained some sort of damage by artillery, but engagement by close air support seems remote. They will have their hands full with other targets, if they aren't hindered by the weather.

• "No other threat weapons system can so hinder attack helicopter operations as can the ZSU-23-4." Although not a weapons system, I feel the attack helicopter and 51 caliber machinegun is our current problem. It can not be overlooked that it would be very easy to occupy an attack position where threat scout forces had penetrated our extended frontages unobserved. Scouts primarily depend on visual contact and even with "steady eyes," enemy occupation of a location could easily go undetected.

Don't take my comments as all negative, because we have our place in the combined arms team. Maintenance and electronic problems of the present attack helicopter are ever present here in Europe. Scouts need as good "electronic eyes" as the guns and they need some type of armament. I submit these ideas from where the rubber meets the roads.

CPT John W. Haker
Attack Helicopter Troop
11th Armored Cavalry Regiment
APO New York 09416

Editor:

Our service section has secured the April 1977 issue of your informative magazine. We find it educational and useful.

How may we receive back issues of the magazine? We are having *Aviation Digest* added to our pinpoint distribution so as to receive future issues.

Thank you for a definitive monthly.

WO1 Jonathan M. Haylock
22d Maintenance Co DS A
Service Section
APO New York 09176

Editor:

I am considering seriously a career as a warrant officer pilot in the U.S. Army. I was a Huey crewchief for 2 years, and am presently enrolled at Embry Riddle Aeronautical University. I am on an associate degree program in aircraft maintenance and hold commercial, instrument, multiengine instructor, and instrument instructor certificates. I also will hold an airframe and powerplant mechanics license with my degree at my graduation in August 1978.

I am out of touch with Army aviation right now, and I would be grateful to the *Digest* if you could have someone "in the know" answer the following questions about Army flying, and the career aspects involved.

• How many hours a year can a new pilot fly if he makes himself available for regular and extra missions?

• Is it possible to get fixed wing transition (I have 600 hours of fixed wing time)?

• Can a new pilot volunteer to become an instructor pilot? If not, what are the requirements?

• What would be a typical first assignment for a new WO1?

• Is it possible for a warrant officer to become a maintenance officer after a few years (of test flying)?

• What aircraft can a new WO1 transition to after basic flight training?

• What types of units do the most flying?

• Is it difficult to become eligible for a full career?

I realize there are no 100 percent right answers to these questions, but even an educated guess would certainly help me out. Also, any printed literature that you could forward to me would be greatly appreciated.

Michael S. McConnell
1400 S. Nova Rd #323
Daytona Beach, FL 32018

• The *Digest* received the following response to Mr. McConnell's letter from the U.S. Army Military Personnel Center.

There are two methods of entry into the Aviation Warrant Officer Training Program which would be applicable to you. The first method requires that you initiate your application through an Armed Forces Enlistment and Examination Station for enlistment under the Aviation Warrant Officer Training Program. The second method would require that you enlist in the Army with subsequent application for flight training. The best method, under your circumstances, appears to be enlistment under the program since the training would be guaranteed as an enlistment commitment.

It is extremely important that you understand that you must be able to qualify both physically and mentally for this training and such a determination can only be made upon making an application. Accordingly, it is recommended that you discuss the entire program with your local Army Recruiting Office for complete details.

To assist in answering your questions, I have enclosed copies of the applicable sections from DA Pamphlet 600-11, "Warrant Officer Professional Development," that pertain to warrant officer aviation. Rather than answering each of your questions individually, I would like to give you an overview of our normal career development pattern that will provide the answers you desire.

Upon completion of warrant officer candidate flight training at Ft. Rucker, AL, candidates are appointed as a warrant officer in MOS 100B and are then eligible for an initial assignment worldwide, normally to divisional aviation units. Location possibilities include both overseas areas (Europe, Korea, Alaska, Hawaii and Canal Zone) and CONUS areas (Ft. Bragg, Ft. Campbell, Ft. Hood, Ft. Polk, Ft. Carson, Ft. Ord, Ft. Lewis, Ft. Knox and Ft. Bliss). All of these tours are about 3 years in length, with the exception of Korea which is 1 year. While in flight training, candidates may express their choices for areas of assignment. The initial utilization tour is designed to allow newly appointed warrant officers to develop their basic flying skills, build experience, and attain knowledge of their profession. Depending on the unit and its mission, new aviators can expect to fly between 150 and 300 hours per year. Generally, air cavalry units and aviation units in Europe, Ft. Bragg, Ft. Hood and Ft. Campbell do more flying, although this is not necessarily a hard and fast rule.

After completing 3 years of warrant officer service, aviators are then considered for transition into one of three aircraft categories: attack helicopters, cargo helicopters or fixed wing aircraft. Transition is not automatic, but is based upon demonstrated manner of performance and entry into career status (either voluntary indefinite or regular Army). At the present time, selected candidates may enter the Scout helicopter program during basic flight training or attend attack helicopter transition immediately upon completion of training. So several aircraft transition options are available. The decision as to which one an aviator receives is determined by individual qualifications and desires and the needs of the Army.

At the 4-year point, aviators are considered for entry into *one* of three functional career tracks. These include operations and training (instructor pilot, instrument flight examiner), aviation maintenance (includes maintenance test pilot) or aviation safety. The criteria for selection is the same as for further aircraft transition mentioned above. If selected to enter a career track, you would have the option of either instructor pilot or maintenance officer, but not both.

In addition to the training options already mentioned, DA Pam 600-11 lists other functional training courses available, such as air traffic control and essential medical training for medical evacuation pilots. Professional development opportunities also include more generalized military education through the Aviation Warrant Officer Advanced Course and the Warrant Officer Senior Course, as well as civilian education opportunities throughout one's career.

There is no simple, definitive answer as to the possibility of fulfilling the goal of an Army career. However, historically speaking, warrant officer aviators who are solid performers and have made professional commitments to Army aviation are able to complete a full career.

Warrant Officer Division will be your Department of the Army career manager if you apply and are accepted for appointment. Please do not hesitate to contact us for further information at (202) 325-7843/7844.

Editor:

Original type Air Force Liaison Pilots' wings which were issued to Army aviators by the Air Force in the 1940s and early 1950s are now available. Write the U.S. Army Aviation Museum at P.O. Box H, Ft. Rucker, AL 36362; or telephone commercial 205-255-4507, AUTOVON 558-4507.

Curator, U.S. Army Aviation Museum

Editor:

Could you please put the following announcement of Transfair '78 in your publication's "Schedule of Events"?

Transfair '78—an International Transportation Exposition and 5-day air and ground show—will be held 16 to 20 August 1978 at the National Aviation Facilities Experimental Center, Atlantic City, NJ.

Anyone having questions please contact Ron Rentfrow, Executive Director at (609) 646-0377.

Gary Shenfeld
Director of Public Relations
Transfair
Atlantic City, NJ 08405

Air Assault School

AIR ASSAULT

Major A. T. Brainerd
Public Affairs Office
Fort Campbell, KY

The design of the air assault badge is symbolic of the helicopter—the source of the 101st's unique mobility and firepower. It follows the precedent set by the parachute and glider badges of World War II

DEPARTMENT OF the Army has recognized Ft. Campbell's Air Assault School as a special skill producing course permitting permanent wear of the air assault badge during assignment to the 101st Airborne Division (Air Assault) and on subsequent assignments elsewhere in the Army.

Post officials at Ft. Campbell, KY, announced that the official recognition was received from Department of the Army on 18 January 1978. This now puts the Air Assault School in the same category as Airborne School, Ranger School and Pathfinder School located at Fort Benning, GA.

With improvements in curriculum, refinement of training techniques and in recognition of the superb performance of the air assault division and the unique skills of the air assault school graduates, the long sought after recognition was approved personally by General Bernard Rogers, Army Chief of Staff.

[See the October 1974 ***Aviation Digest*** (pages 2 and 3) for articles about the original authorization of the Air Assault Badge for Soldiers assigned to the 101st Airborne Division—and also about the establishment of the Air Assault School.]

Since the Air Assault School's inception in February 1974, 9,304 Soldiers have earned the air assault badge, including most of the current commanders and staff and the division commander. General John A. Wickham Jr., as had previous air assault qualified commanders, Generals Berry and McEnery, purchased Armywide approval as recognition for the air assault Soldier's many contributions as displayed by continued successes of this division.

These requests for approval stressed the unique skills of rappelling, pathfinder operations, airmobile fire support, aeromedical evacuation rigging, sling load operations and combat assaults as "essential to full, efficient utilization of the helicopter on today's battlefield."

When asked his reaction to the approval of the school, General Wickham said, "This important achievement continues the airborne legacy. Through the colorful heritage of this division, troopers have worn the glider badge, the parachutist badge and now the air assault badge. This badge represents a Soldier's mastery of skills required to combine effectively the capabilities of assault troops with the unprecedented mobility and firepower capabilities of helicopters on the modern battlefield."

The design of the air assault badge is symbolic of the helicopter—the source of the 101st's unique mobility and firepower. It follows the precedent set by the parachute badge and glider badge made famous during World War II.

Although the Air Assault School is a focal point of the post and division, this official recognition is expected to increase the number of applicants for the Air Assault School with its tough physical and professional standards.

General Wickham summed up the announcement with, "Can you imagine the impact this recognition will have on former 101st Soldiers the world over? The air assault qualified Soldier has finally received deserving recognition."

The Screaming Eagles continue to be "Air Assault all the way."

KNOW THE THREAT

ZSU-23-4

THE ZSU-23-4 is a self-propelled antiaircraft system mounting four 23 millimeter guns. The Soviets introduced the system in 1965 and today it is found in several Warsaw Pact armies.

Mounted on a light tracked chassis, the ZSU-23-4 is capable of delivering fire on air targets while moving with troop combat formations. Its missions include defending fixed installations, combat formations or enroute columns from hostile aircraft at altitudes up to 1,500 meters. The weapon also can be used against ground targets. Its range of effective fire is 2,500 meters.

For additional information on the ZSU-23-4, see the following issues of the ***Digest***: September 1974, March 1976 and November 1977.

For copies of these articles please write: The Editor, U.S. Army Aviation Digest, Post Office Drawer P, Fort Rucker, AL 36362.

USAAAVS

Summer Thunderstorm, p

Pilot Enemy Number 1

EACH YEAR at this time, pilots begin to look forward to that easy-going summer flying. But too often, flight is rudely interrupted by a local weather phenomenon called the summer thunderstorm.

Highly dangerous

The summer thunderstorm is the ultimate growth form of cumulus activity and must be considered highly dangerous because of its heavy rain, icing conditions, hail, lightning, strong windsheers, and severe turbulence.

Obviously these packets of violence must be avoided, but that's not always easily done. With a good working knowledge of this weather phenomenon and using tried flying techniques associated with it, your chances of survival are vastly improved.

Generally, thunderstorms are common from late winter to early fall, with June, July, and August being the months having the highest frequency of storms. Although the Pacific coast has an occasional summer thunderstorm, the Southeast, especially Florida, has the highest number of instances per day, per year, over a specific region. According to one source, about 44,000 thunderstorms churn daily over the earth's surface. At least 1,800 of these are in progress at any given moment, discharging lightning flashes at the rate of 100 every second and generating heavy precipitation, hail, and violent winds. While some thunderstorms are associated with frontal systems, others are not.

Recognizing the storm

As a thundercloud develops, it forms puffy, rolled-looking sides as it extends upward. Through growth and change, its top spreads out in an anvil shape. Direction of this horizontal anvil indicates the direction of the storm. One positive indication of a thunderstorm is the squall or roll cloud that extends downward from the main base of the storm. This highly turbulent cloud is located along the front and bottom of a violent thunderstorm. Its appearance means plenty of severe weather lies within the storm. Because winds are gusty and strong below the storm cloud, usually blowing up and into the storm from in front and down and out of it from behind, an aircraft flown too close to the roll cloud could be inadvertently hurled into the storm. The possibility of this happening is greatest at night or when the roll cloud is hidden behind other clouds surrounding the storm.

When thunderstorms are associated with a frontal system, they may be organized in long bands that progress ahead of the front. These are commonly referred to as squall line thunderstorms. Horizontally, they may extend a hundred or more miles while reaching altitudes of 60,000 feet or higher. These thunderstorms may be imbedded in stratified and multiple cloud layers and not be visible.

Hail

Sometimes a thundercloud will tilt with the wind. Clear air under a tilted thundercloud or between thunderclouds slanting toward each other can be especially turbulent and may contain hail. At present, we have no positive means of recognizing or forecasting a storm that will produce hail. *It is a safe bet, however, to always assume that hail will be present at some place and time within a thunderstorm.* Although hail encounters are generally of a short duration, they can inflict severe damage on an aircraft. *If you're ever suddenly caught in a hail shower (shaft), you should turn in the direction of the hail fall and descend with it until clear.*

Lightning

Lightning strikes on any part of a rotor blade can have drastic results. It is particularly rough to lose any part of a blade, which is a real possibility. It will set up the vibration or beat and start to overstress (or disintegrate!) the aircraft completely. If lightning strikes a blade or spar, there is the potential of losing that section of blade or the whole blade itself. If it strikes the airframe, you may encounter a total electrical failure and have only a partial panel to work with. Throw in some turbulence and there goes even the partial panel.

Most lightning is found in the upper cell regions, and almost all is from cloud to cloud. Operations should be confined to the lower one-third of the cloud, and if lightning is experienced, you should take the aircraft lower. If a lightning strike occurs, find the nearest field and completely check the helicopter over before resuming flight.

Airmass thunderstorm cells build up over land during the heat of the day and usually break in late afternoon or early evening. However, either airmass or frontal type thunderstorms may be encountered at any time.

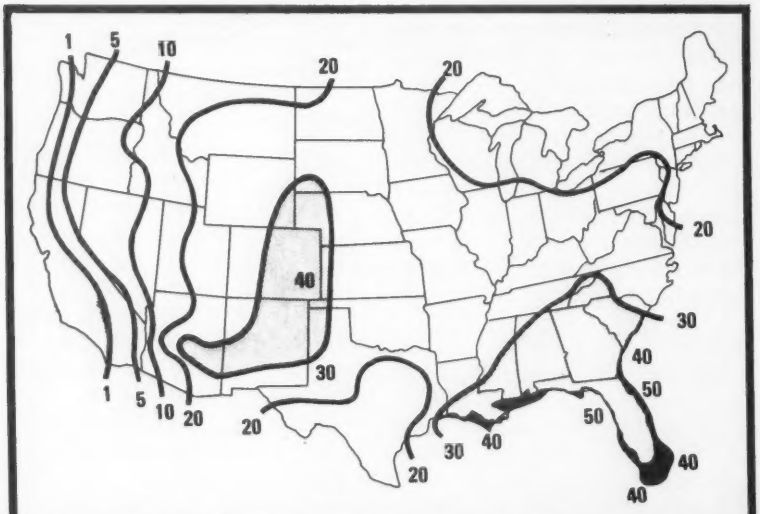
SUMMER THUNDERSTORM, PILOT ENEMY NUMBER 1

Vortices

Observations and studies completed more than 10 years ago indicate that vortices, or tubes, of tornadic or near-tornadic intensity may be encountered in and under innocent-looking lines of clouds extending from thunderstorms. These vortices are invisible and may exist as far as 20 nautical miles from the associated thunderstorm. Because lightning and air turbulence in their vicinity may be light or moderate, they cannot serve to indicate the presence of vortices. Sometimes their presence can be detected by noting dust-whirls over land areas or swirls on the surface of water. These tubes may extend to great heights within flanking cloud lines, often to 18,000 feet mean sea level and sometimes as high as 35,000 feet near the thunderstorm. Neither the tubes nor the embedding clouds can be reliably detected on airborne radar, although ground radar may detect the cloud line if it is within 30 miles and no heavy precipitation accompanies it.

Another important aspect of this hazard is the great distance from the associated thunderstorm at which these tubes may exist. Further, it appears that these tubes occur more frequently than do visible tornadoes. Since no completely reliable local indications of the existence of vortices presently exist, avoidance must be based on knowledge of the presence of thunderstorms with which these cloud lines and tubes are often associated and flight procedures to avoid the cloud lines. *A general rule is to suspect tornadic vortices any time a thunderstorm forecast includes the possibility of tornadoes, whether the thunderstorm is of an airmass or frontal system type.*

Numerous examples of aircraft inadvertently encountering these tubes have been documented. In one, an airliner was climbing out through a saddle between two cells at 18,000 feet when it encountered what is believed to have been the top of a horizontally oriented tornadic tube that existed between the two cells. The airspeed dropped to zero and the aircraft was nosed down. In the absence of relative flow for lift but undergoing acceleration in the vortex flow, the aircraft responded in a high velocity dive. Fortunately, it cleared the vortex in its forward motion and as the airspeed approached Mach 1, the captain reversed the engines in an attempt to slow the aircraft and, luckily, was able to save it. Other pilots have not been as fortunate.



Average number of days each area has thunderstorms during summer months

Today, scientists appear to agree that tornadoes occur more often on the flanks of severe thunderstorms some distance away from heavy rain and lightning, and near the trailing edge of a squall line, and that the greatest hazard lies on the flank of severe thunderstorms where invisible tornadic vortices are occurring below the base and within innocent-appearing clouds. These vortices produce no radar returns and usually have a common base with the thunderstorm at distances that range more than 20 miles from the rain and lightning beneath the storm. *The only indicator to alert the pilot to this invisible destructive force is his knowledge of how near a storm cloud or system he can expect to encounter a tube.* This bit of knowledge also provides him his only defensive action—avoidance.

Procedures

What about those procedures listed in the operator's manual for each type aircraft? They are most important, but we must understand one thing clearly: While they are

the best procedures to use when caught in severe turbulence, *they should in no way be interpreted as an endorsement to fly through any thunderstorm.* They cannot assure your safety. In brief, they can be divided into three areas: aircraft preparation, storm penetration and followup or after flight through a turbulent area.

Preparation

Ready your aircraft for thunderstorm penetration before entry by doing the following:

- Set instrument and cockpit lights to full bright.
- Turn on pitot heat and anti-icing systems.
- Check cargo (if applicable) for security and notify crew and passengers of the possibility of encountering severe turbulence.
- Lock shoulder harness and direct crew and passengers to secure restraint devices.
- Disengage all ASE equipment.
- Turn off radio equipment not needed.
- Adjust power settings and reduce airspeed to that recommended by the operator's manual. In the case of rotary wing aircraft, a slight increase of operational rpm will make the blades more rigid and increase the stability of the rotor system. Trim the aircraft for penetration airspeed.

Penetration

- If you have a choice, establish a penetration altitude between 4,000 and 6,000 feet above the highest terrain. This altitude has been found to be the least turbulent. It also is high enough to take care of downdrafts. Hail and ice as well as more severe turbulence are found at 10,000 to 12,000 feet and these altitudes should be avoided.
- Keep power settings as constant as possible. Airspeed indicators often give false readings in vertical drafts and heavy rain.
- If possible, select the heading that will take you through the storm in the least amount of time. To help determine your best heading, use all available indicators such as radar, lightning flashes and storm appearance. Establish your heading and maintain it. Don't turn around.
- Keep the wings as level as possible to aid in maintaining your heading.
- Concentrate on maintaining a level attitude. Avoid "chasing" the airspeed and trying to correct for altitude lost or gained due to up or down currents unless it is absolutely necessary to clear obstructions.
- Avoid any unnecessary maneuvering, and be gentle and easy on the controls.
- Finally, because of high, unpredictable gusty surface winds in addition to possible hail, rain and poor visibility, never try to land or take off if a thunderstorm is near the field or close to your takeoff or approach path.

After flight

- Following flight through severe turbulence, check your aircraft for possible structural damage and, if deemed advisable, make a precautionary landing.
- To help keep other pilots out of trouble, make an in-flight report to both air traffic control and military METRO (Pilot-to-Military Weather voice call), if possible.
- Before landing, it may be wise to check aircraft handling characteristics in the landing configuration, making sure you don't allow the aircraft to stall. If runway length is ample and other conditions are satisfactory, consider adding a few knots to the normal approach airspeed.
- Write up any damage on the DA Form 2408-13 and, if warranted, request a complete check of your aircraft by a qualified maintenance activity.

Granted, while procedures outlined are not all-inclusive, they serve as a guide to help ensure your safety. Review and follow them, bearing in mind that the only recommended and safe policy when confronted with thunderstorms is to avoid them.

PEARL'S

Personal Equipment & Rescue/Survival Lowdown

If you have a question about personal equipment or rescue/survival gear, write Pearl, DARCOM, ATTN: DRCPO-ALSE, POB 209, St. Louis, MO 63166

Use Official Mail

PEARL receives many letters from people the world over with problems or suggestions on aviation life support equipment (ALSE). Many of these letters are handwritten using personal envelopes and postage stamps, which is just great, except we consider the mail as "official." Therefore, you are allowed to use government envelopes which *do not* require stamps.

SRU-21/P Survival Vest Views

I recently visited an Air Force ALSE unit and found they have items in their SRU-21/P survival vest that we do not have in ours of the Army. The Air Force SRU-21/P has a whistle and insect repellent. I would like to have these items in our Army vest.

So be it, if you would like the whistle and insect repellent in your SRU-21/P, there is space available. You may requisition the Whistle, NSN 8465-00-254-8803, from S9T (Defense Personnel Support Center) and Insect Repellent, Personnel, NSN 6840-00-142-8965, from S9G (Defense General Support Center). We will ask the SRU-21/P manager about adding the whistle and insect repellent as permanent items.

Survival Food/Drug Inspection

I am attempting to inspect my unit's aircrewmember's survival kits, to ensure that the food and drugs are acceptable to use. However, I am finding it extremely difficult, since there is no inspection criteria on checklists for these items. Please—help!

You are right. There are no inspection checklists for these critical food and drug items. The U.S. Army Materiel Development and Readiness Command (DARCOM) project officer for ALSE has a draft inspection checklist now in typing. This inspection criteria should be available later this year. But now, back to your problem, so let me answer one at a time.

Food—if you notice that you have food containers that are swollen or leaking, they are obviously bad, so replace them. At least on an annual basis you should take a lot sample from your survival kits to your post (or nearest) veterinarian. The veterinarian is the Army's authority on food testing. If any food from a particular lot is discovered to be contaminated, that entire lot number of food should be removed from your survival kits and new food requisitioned. In the interim it is better to issue survival kits to your unit's aircrewmembers without food items, than take a chance of issuing a survival kit with contaminated food.

Drugs—these items also require periodic inspection to ensure that they have not become toxic. Medical Department Supply Information Army SB 8-75-3 lists drug items which should no longer be used. Your nearest medical facility or support unit has this publication. So ask the Doc to take a look-see and advise you if your particular lot number of drug items are safe to use. If for some reason your medical facility is unable to answer your questions, you may call Major Joe Costanza, AUTOVON 343-2045, of the U.S. Army Medical Materiel Area, Fredrick, MD, or Mr. Leon Jozwiak, AUTOVON 444-2191, of the Defense Personnel Support Center, Philadelphia, PA.

Don't Do It

If your AN/PRC-90 survival radio is not performing as designed, you should get it in for a checkup. The Maintenance Allocation Chart (MAC) of TM 11-5820-800-12 tells you to send your sick radio to Lexington Bluegrass Army Depot for repair—*don't do it.*

TM 11-5820-800-12 is being changed to advise you to send your no-go radio to Sacramento Army Depot, ATTN: Transportation Officer; mark for: Depot Stock Condition Code F, Sacramento, CA 95801.

Hold on—you're not finished yet! Condition Code F means that your radio is repaired and returned to depot stock. To get a replacement radio, you must resubmit a requisition to B16 (U.S. Army CERCOM, Ft. Monmouth, NJ 07703). Be sure to indicate on your requisition that you are ordering "replacement" radios rather than "initial" issue.

Air Force/Navy Publications

I have noticed that the Aviation Life Support Equipment (ALSE) Bulletin and the ALSE Pamphlet lists a number of Air Force and Navy publications on ALSE used by Army aircrewmembers. Where or how do we obtain the Air Force and Navy publications?

The Air Force and Navy publications listed in the pamphlets you referenced will provide you with valuable assistance in the use and maintenance of your ALSE. Army Regulation (AR) 310-70 outlines the procedure for you to obtain the sister service publications you need.

SPH-4 Flight Helmet

The SPH-4 flight helmet was designed to protect your head during all "unprogramed" delays in your flight (i.e., meeting a hillside in the sky, crash landings, etc.). To ensure that your "unprogramed" delay is a memorable experience, one that you can tell your grandchildren about, it is essential that your SPH-4 helmet remain on your head and stops flying at the same time that you do.

A MAILER TITLED "You Wanna Hear From Me?" was included in the November 1977 issue of the *Digest.* Major General James C. Smith, commander, U.S. Army Aviation Center, asked that individuals in aviation units throughout the world write to him expressing their views on ways to improve training at the Aviation Center. The following are some of the comments mailed to MG Smith and his response to them. Additional comments and responses will appear in subsequent issues of the *Digest.*

Dear General Smith:

I recommend that applicable flight training guides and applicable aircraft TCs be included in each Aircrew Training Manual to make the ATM a single source manual along with the applicable — 10. These two documents, the ATM and — 10, then would be the cornerstone for aircrew training.

The aircrew training manuals are in the process of revision and are scheduled to be in the field in September. They will be the single source document for flight training. All information that is contained in the standardization and qualification Training Circulars will be included in the ATMS and will be used as the single source document both in the Aviation Center and the field.

Thank you for responding,
General Smith

Dear General Smith:

My comment concerns Aircrew Training Manuals and pilot-in-command policies. As an instructor pilot/instrument examiner my job in the field would be vastly improved by implementation of a system where aviators who are at the pilot's section of an aircraft *are* in fact fully responsible for their actions (except when with an IP). On a normal mission, in an average Army aviation unit, an observer (or a unit commander or operations officer) cannot tell who is in the pilot's seat/copilot's seat—not to mention who is flying the aircraft. To help alleviate this problem I propose that DA establish criteria for positions of pilot and copilot and effectively eliminate any interpretation of ARs by commanders and airmen.

I appreciate your concerns in this area. However, I feel AR 95-1 adequately covers pilot-in-command procedures, requirements, designations and responsibilities. Paragraph 1-18, Section II, AR 95-1 (Pilot-in-Command) is sufficiently comprehensive, yet flexible enough for commanders to properly supervise and efficiently use their aviator resources. In light of this, inclusion of specific pilot-in-command criteria and procedures such as seat positions, would not be necessary.

Thank you for responding,
General Smith

tactics

doctrine

AVNEC Concluded

THE ARMY Aviation Employment Conference (AVNEC) was concluded on 31 March at the U.S. Army Aviation Center after more than 50 general officers and other key military and civilian personnel developed consensus recommendations in four key areas affecting Army aviation. These will be presented for consideration to the Vice Chief of Staff of the Army at the Army Aviation Systems Program Review (AAPR) scheduled for November.

AVNEC attendees came to Fort Rucker from around the world and represented all units and agencies involved with Army aviation. The conferees were divided among four workshops.

- Army Aviation "How to Fight"—Offense
- Army Aviation "How to Fight"—Defense
- Interoperability/Standardization
- Army Aviation Personnel and Training Problems

They analyzed Army aviation doctrine, tactics, employment concepts and established priorities for new aviation equipment items.

The Directorate of Combat Developments at the Aviation Center was responsible for planning and conducting AVNEC (the project officer Major Frank T. Peterlin can be reached by calling AUTOVON 558-3702/3733).

The *Digest* will carry articles concerning the four study areas beginning next month with Interoperability/Standardization.

priorities

concepts